PIT AND QUARRY

AUGUST, 1939

National Gypsum's New Plant at Savannah . . . Block Manufacture Solves Surplus-Sand Problem
Stock-Piling System Keeps Plant Independent of Mine . . . Attractive Buildings Promote Sales

10 YEARS—3,600,000 TONS

...AND IT'S NOT THROUGH YET!

THE Goodyear Style "B" conveyor belt pictured here was first installed on the main stone conveyor in the quarries of the Sturgeon Bay Company, Sturgeon Bay, Wisconsin, in April 1928 on specification by the G. T. M. — Goodyear Technical Man.

Operating in a wet tunnel, continuously exposed to damp and moisture, it was in service here almost ten years to the day—*handling 3,600,000 tons of crushed stone at a belt cost of only .00082¢ per ton!*

That would be a grand record for any belt under such conditions, but the Goodyear wasn't through yet. To be sure, it was frayed at the edges from idler wear, but it was still sound at the core. So in April 1938 it was cut down from 40" to 30" width and installed on the rock crusher return conveyor — *where it is still in service today, piling up its tonnage total!*

YOU CAN DO IT BETTER WITH GOODYEAR RUBBER

Consult the G. T. M.

Let the G. T. M. tell you about the special features of Goodyear conveyor belts that insure such exceptional service—their tire-tread-tough, abrasion-resisting covers—their secret mildew-inhibiting friction that resists damp-rot attack. Let him show you how they are correctly specified to match the frequency and severity of both flexing and abrasion on your particular job.

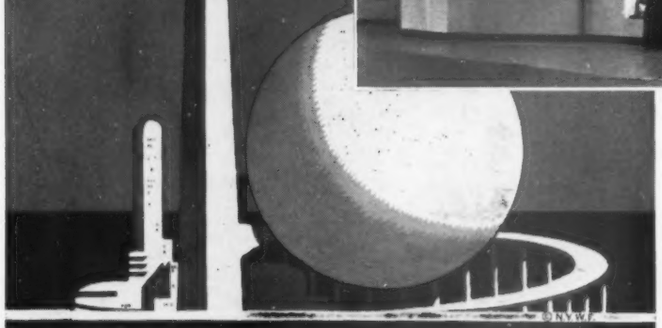
To bring the G.T.M. to your office, just write Goodyear, Akron, Ohio, or Los Angeles, California — or phone the nearest Goodyear Mechanical Rubber Goods Distributor.

Centennial of Charles Goodyear's discovery of vulcanization

THE GREATEST NAME IN RUBBER

GOODYEAR

FOR ALL TO SEE!



NEW YORK WORLD'S FAIR 1939

Main Exhibit

METALS BUILDING
(OPPOSITE TRYLON)

●

Stoker Exhibit

HOME BLDG. CENTER

● Millions of people who visit the New York World's Fair, will gain a new insight into the benefits of mechanical handling and power transmitting from what they see and hear at the Link-Belt exhibit.

With so many things to occupy our time these days, too much is taken for granted. We accept ever-lower prices on ever-better commodities in ever-increasing number, as a matter of course... seldom giving a thought to the reason why our hours of work will buy so much of life's necessities and pleasures.

Probably no other manufacturer of mechanical equipment is better qualified to tell this story. Progressive management in every industry from Maine to California — from Minnesota to Florida, is using Link-Belt equipment to multiply the value of individual endeavor. And for more than 60 years, Link-Belt has worked hand-in-hand with the men and women in industry who have made America the envy of the world.

American Industry and American business brains have found the way to pay better wages . . . to work shorter hours . . . to pay more for raw-stuff... and still, with the help of mass-production and mass-distribution, to give our people what they want . . . at prices they can pay. 7819-A

LINK-BELT COMPANY

Philadelphia Chicago Indianapolis San Francisco
Atlanta Offices in Principal Cities Toronto

MACHINERY *Points the Way to Better Living*●

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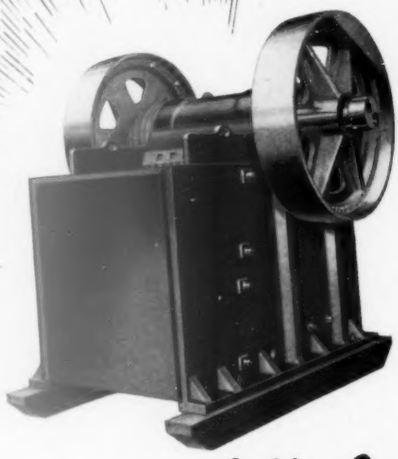
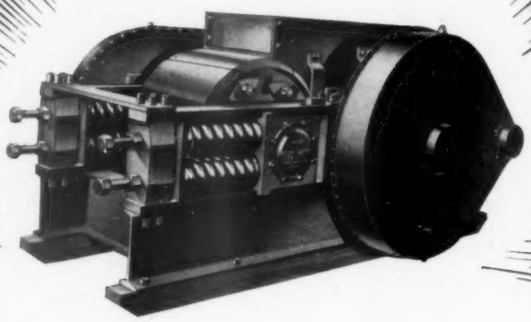
Announcing 2 New Cedarapids CRUSHERS



25" x 40" Roller Bearing JAW CRUSHER

A Big crusher for Big rocks — can be fed direct from shovel — reduces amount of intermediate breakage usually necessary with smaller crushers — narrow angle of nip assures rapid, continuous downward travel of rock in jaws — welded reinforced steel frame reduces weight and increases rigidity and strength — larger shafts and oversize roller bearings with special Cedar Rapids seals increases the life of the crusher and reduces the operating cost. A Primary Crusher that IS a money saver.

Write For Bulletin



40" x 24" Roller Bearing ROLL CRUSHER

A specially designed, extra heavy, secondary crusher for tough jobs — 24" width gives more capacity — segmental shells that are easy to replace — totally enclosed bearings requiring lubrication only once a year — oversize chrome molybdenum star gears — oversize springs — simplified adjustment — will crush all types of rock faster and more economically.

Write For Bulletin

IOWA MANUFACTURING COMPANY
CEDAR RAPIDS • IOWA

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PORTABLE and STATIONARY
CRUSHING PLANTS • WASHING PLANTS
ASPHALT MIXING PLANTS
MATERIAL HANDLING EQUIPMENT

KOEHRING

Koehring Chain Crowd

is a single continuous chain traveling *inside* of the high strength, welded boom. Chain tension is automatically maintained regardless of boom movements. Design and location of sprockets permits the sprocket centers to move without change in center distance. No back lash or slapping chains to cause drum shocks. Boom is quickly lowered or raised without manual adjustments or affect on crowding effort. Crowding action is positive and absolutely independent of the pull on the hoist line.

THE KOEHRING COMPANY
MILWAUKEE • WISCONSIN

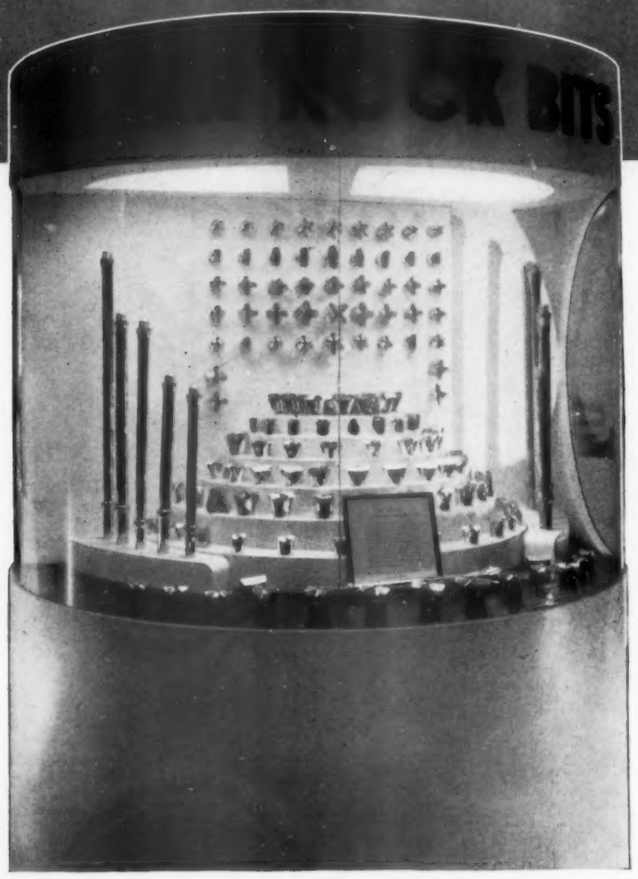
The crowd chain leads in a straight line from a sprocket on the shipper shaft down under the boom foot sprockets and up to a halved sprocket bolted to the skeleton drum on the front drum shaft.

KOEHRING HEAVY DUTY

HEAVY-DUTY CONSTRUCTION EQUIPMENT

TIMKEN

ROCK BITS AT THE NEW YORK WORLD'S FAIR



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INTERESTING HIGHLIGHTS OF THE TIMKEN EXHIBIT

One of the first automobiles to be equipped with TIMKEN Bearings.

A TIMKEN Roll Neck Bearing having a load capacity of nearly three million pounds.

A machine that measures the thickness of a human hair in hundred-thousandths of an inch, as a demonstration of the precision with which TIMKEN Bearings are made.

A diorama showing in miniature the world's largest electric steel furnace—capacity 75 tons of steel per heat.

A TIMKEN Fuel Injection Pump cut away to show the internal mechanism in operation.

The various parts of a TIMKEN Bearing automatically assembling and disassembling to demonstrate the tapered design and construction of the TIMKEN Bearing.

A display dramatizing the Timken Roller Bearing Company's contributions to modern locomotive design—including TIMKEN Locomotive Bearings, main rods, side rods and other reciprocating parts.

And

THE TIMKEN ROLLER SKATERS in a sensational novelty act performed on a platform only nine feet in diameter elevated seven feet above the floor. The skaters perform ten times daily.

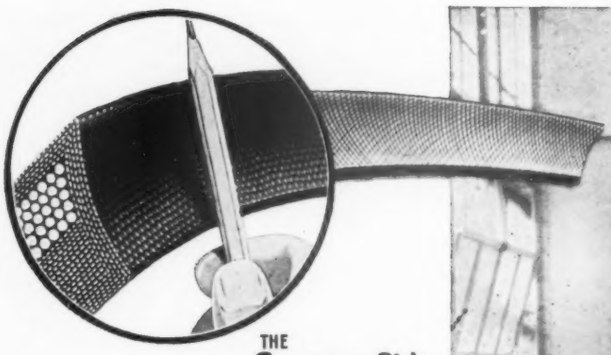
Also be sure to see the many Timken Bearing Equipped locomotives and cars in the Railway Track Exhibit.

Among the many valuable educational features of the Timken Exhibit is a wonderful display of TIMKEN Rock Bits. A portion of this is shown above. No one who has anything to do with the drilling of rock can afford to miss this splendid exposition of modern rock drilling methods.

TIMKEN

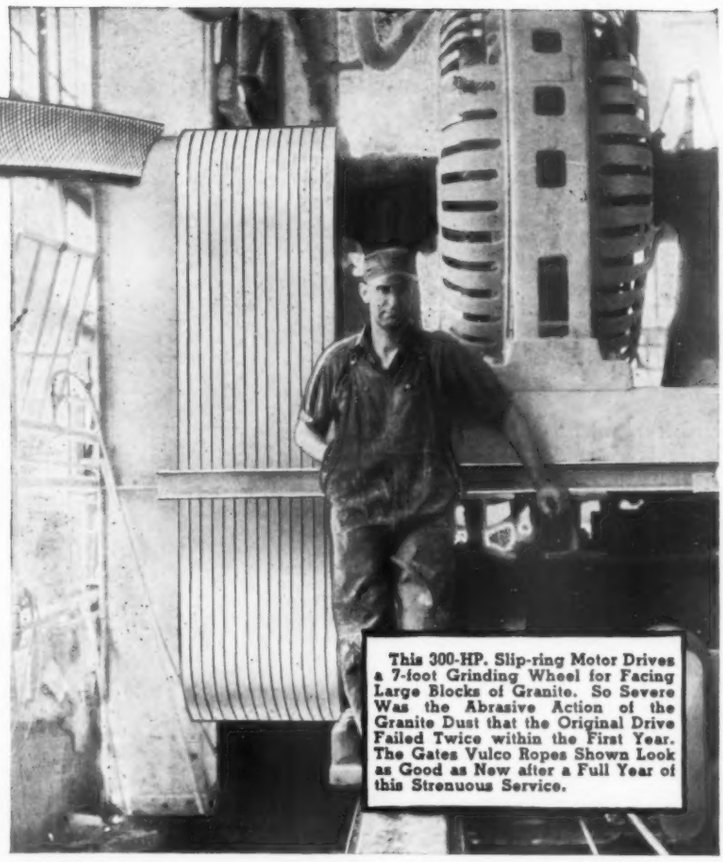
TRADE-MARK REG. U. S. PAT. OFF.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



THE **Concave** Side
IS A GATES PATENT

SAVE MONEY on BELTS and POWER....



This 300-HP. Slip-ring Motor Drives a 7-foot Grinding Wheel for Facing Large Blocks of Granite. So Severe Was the Abrasive Action of the Granite Dust that the Original Drive Failed Twice within the First Year. The Gates Vulco Ropes Shown Look as Good as New after a Full Year of this Strenuous Service.

With This SIMPLE PATENT!

What Happens When a V-Belt Bends

FIG. 1

FIG. 2

When *any* V-Belt bends, its top is under *tension* whereas its bottom is under *compression*. Naturally, the top grows *narrower*, the bottom *wider*. Figure 1 (on the left) shows this shape-change in a straight-sided V-belt. Note the out-bulge of the sides. You can actually *feel* this side-bulge if you grip a bending V-belt in your fingers as in the photo above.

Now look at figure 2 and note how the patented concave side exactly *corrects* the previous distortion—*eliminates* the side-bulge—gives the bending belt a shape that *precisely fits* the sheave groove.

Two substantial savings result: (1) No side-bulge means uniform side-wall wear—*longer life!* (2) Full side-wall grip on the pulley means *more* grip—heavier loads without slippage—belt wear reduced—power used, *not wasted*.

The Gates Vulco Rope is the only V-belt built with the patented concave side.

THE GATES RUBBER COMPANY

Engineering Offices and Stocks in All Large Industrial Centers

GATES VULCO ROPE DRIVES

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BUCYRUS-MONIGHAN
9-W
WALKING DRAGLINE
Owned by J. A. Terteling & Sons and operating near Gothenburg, Nebraska, this New Bucyrus-Monighan 9-W uses a 160-foot boom.
BUCYRUS MONIGHAN
Sold by
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SOUTH MILWAUKEE, WISCONSIN

it's

Performance that REALLY counts!

FOUR MORE HUGS ADDED TO MISSOURI PORTLAND CEMENT COMPANY'S FLEET

In February, 1937, the Missouri Portland Cement Company purchased three Model 99 Hug Heavy Duty Quarry Trucks with Heavy Duty Rock Bodies for their Independence, Missouri plant.

The performance of these three Hugs was so satisfactory that the Missouri Portland Cement Company again purchased Hugs in carrying out its modernization program of its Fort Bellefontaine, Missouri plant.

Such performance is standard with Hugs. Special "Built to meet a Condition" Hug design plus Hug's eighteen years of actual experience in the heavy duty transportation field have taken all the guesswork out of quarry transportation problems.

Check your quarry transportation costs now and then let the Hug engineers show you how you can reduce them to an all-time low.

Write today for complete information on the Hug Quarry and Hug Roadbuilder line of Heavy Duty Trucks.

Model 99 Hug Heavy Duty Quarry Truck loading under a 3 yd. Marion Electric Shovel at Missouri Portland Cement Company's Fort Bellefontaine, Missouri Quarry.

Backing up to the Loading Apron Conveyor.

Unloading into the Loading Apron Conveyor.

HUG

The HUG Company

602 CYPRESS STREET, HIGHLAND, ILLINOIS

Economical in Small Blasts too..

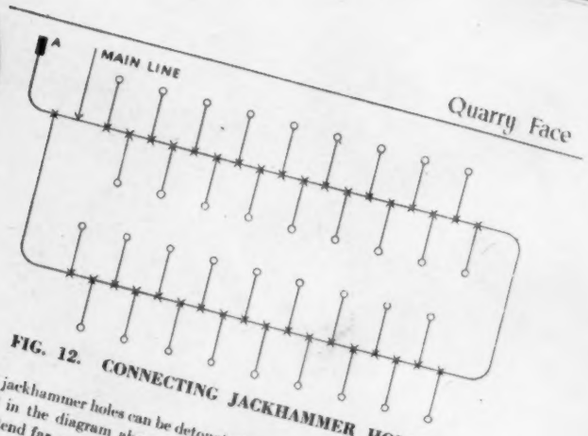

FIG. 12. CONNECTING JACKHAMMER HOLES

A series of jackhammer holes can be detonated economically by the use of Primacord, as illustrated in the diagram above. The branch line Primacord from each hole is allowed to extend far enough to make a wrap connection with a main line Primacord laid midway between the rows of holes. For instance, if the rows are 6 ft. apart the Primacord would extend out of each hole a distance of approximately 3½ ft. Regular connections with the main line are indicated at points X, and two or more rows of holes can be detonated simultaneously, by connecting their main lines with regular connections as shown. The entire blast is detonated by means of a fuse and cap or an electric blasting cap properly attached to the main line at point A.

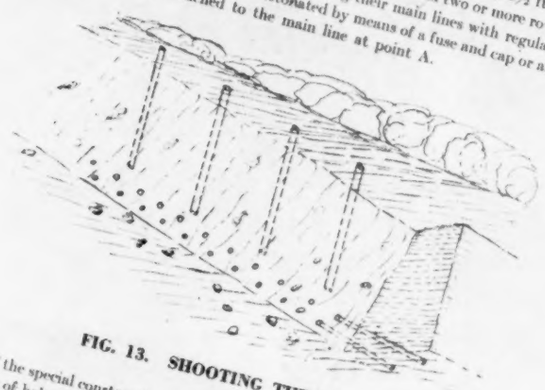

FIG. 13. SHOOTING THE TOE

Because of the special construction of Primacord-Bickford, it is possible to detonate a large number of holes placed at very close intervals without danger of cut-offs. This feature is particularly advantageous in shots where holes are used in shooting the toe in conjunction with well drill holes.

PAGE FOURTEEN

Primacord-Bickford is an instantaneous detonating fuse which must be detonated with a fuse and cap or electric blasting cap. It acts as the detonating agent in each hole, and also connects all holes. It can be employed profitably in small as well as in giant blasts, as shown in these diagrams.

Send for a copy of the Primacord-Bickford book—free to executives.

THE ENSIGN-BICKFORD CO., SIMSBURY, CONN., U. S. A. *Makers of Ensign-Bickford Safety Fuse since 1836*

PRIMACORD-BICKFORD *Detonating Fuse*

PB11

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For nearly a decade Pit and Quarry has led the field in subscriptions among producers. Its popularity has grown constantly, its margin of lead increased steadily, not by any sudden bound due to special offers or inducements. Its volume of advertising in 1938 was definitely larger than that of any other paper in the field.

The reason? At no time has Pit and Quarry compromised with its high editorial standards. It has held its editorial staff, and kept its field editor on the road, wearing out a car in one to two years. The illustrations have always been plentiful, the articles easy to read.

Costly to do this? Yes, it is. But it has been worth the cost, for producers realize that Pit and Quarry has worked with them. And the high percentage of subscribers who renew their subscription attests their loyalty to a publication understanding their problems and working with them.

The subscription price is still only one dollar for a full year's service. If you are not already a subscriber, why not send in a dollar and learn why other producers find Pit and Quarry so valuable? The cost is small—the results so large—don't delay.

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BRANCHES IN PRINCIPAL CITIES

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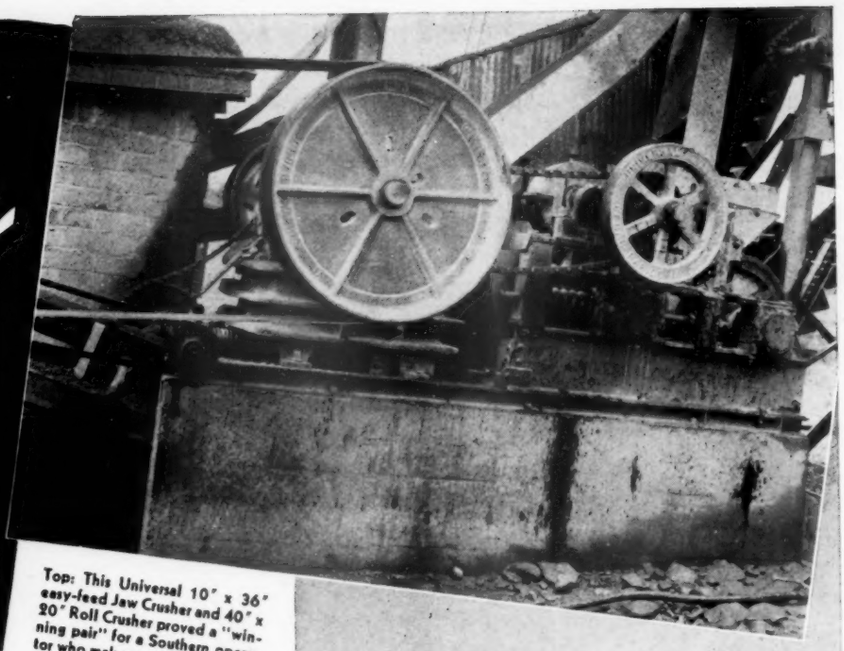
TOUGHER—Provides maximum resistance against wear, sudden shocks, vibration

SAFER—Unequalled for uniformity of quality

SAVING—Insures lowest general average operating cost

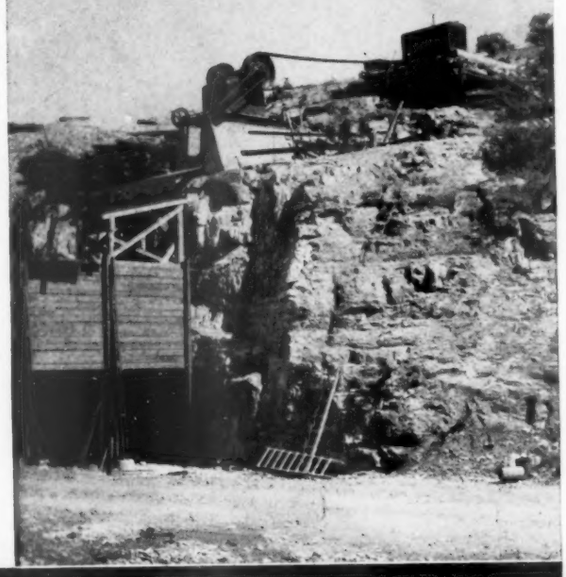
A Winning Pair!

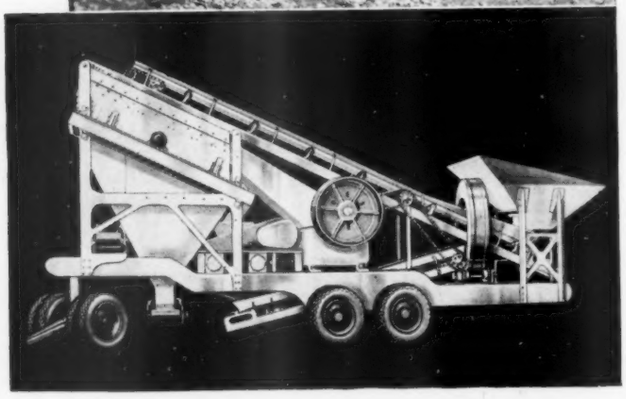


Top: This Universal 10″ x 36″ easy-feed Jaw Crusher and 40″ x 20″ Roll Crusher proved a "winning pair" for a Southern operator who makes worthwhile profits on every ton.

Right: It's up high, but rock crushing costs are low with this 24″ x 36″ Crusher at a Montana quarry. The screen is a 4′ x 10′ Universal.

Below: The new Universal Portable Duplex Plant with the Universal Rotavator which helps to cut size and weight and increase efficiency and capacity of this gravel plant.





Universal Jaw Crushers and Secondary Roll Crushers are a winning pair in any quarry or pit. With their fast, dependable crushing to uniform size and low maintenance cost, you can't lose.

With over 33 years of experience building rock crushing equipment exclusively, Universal engineers know what it takes for profitable operation and you get it in every Universal Equipment.

Universal builds stationary and portable crushing, screening and washing plants for gravel or any rock from limestone to trap; also pulverizers, scrubbers, sand drags and bins.

Universal Advisory and Planning Service and fast Replacement Parts Service from 15 strategic points is another "winning pair" you should not overlook in contemplating new equipment.

Write for bulletins on various equipment or new complete catalog.

UNIVERSAL CRUSHER COMPANY

619C Avenue West
Cedar Rapids, Iowa

UNIVERSAL

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PIT AND QUARRY

Vol. 32 August, 1939 No. 2

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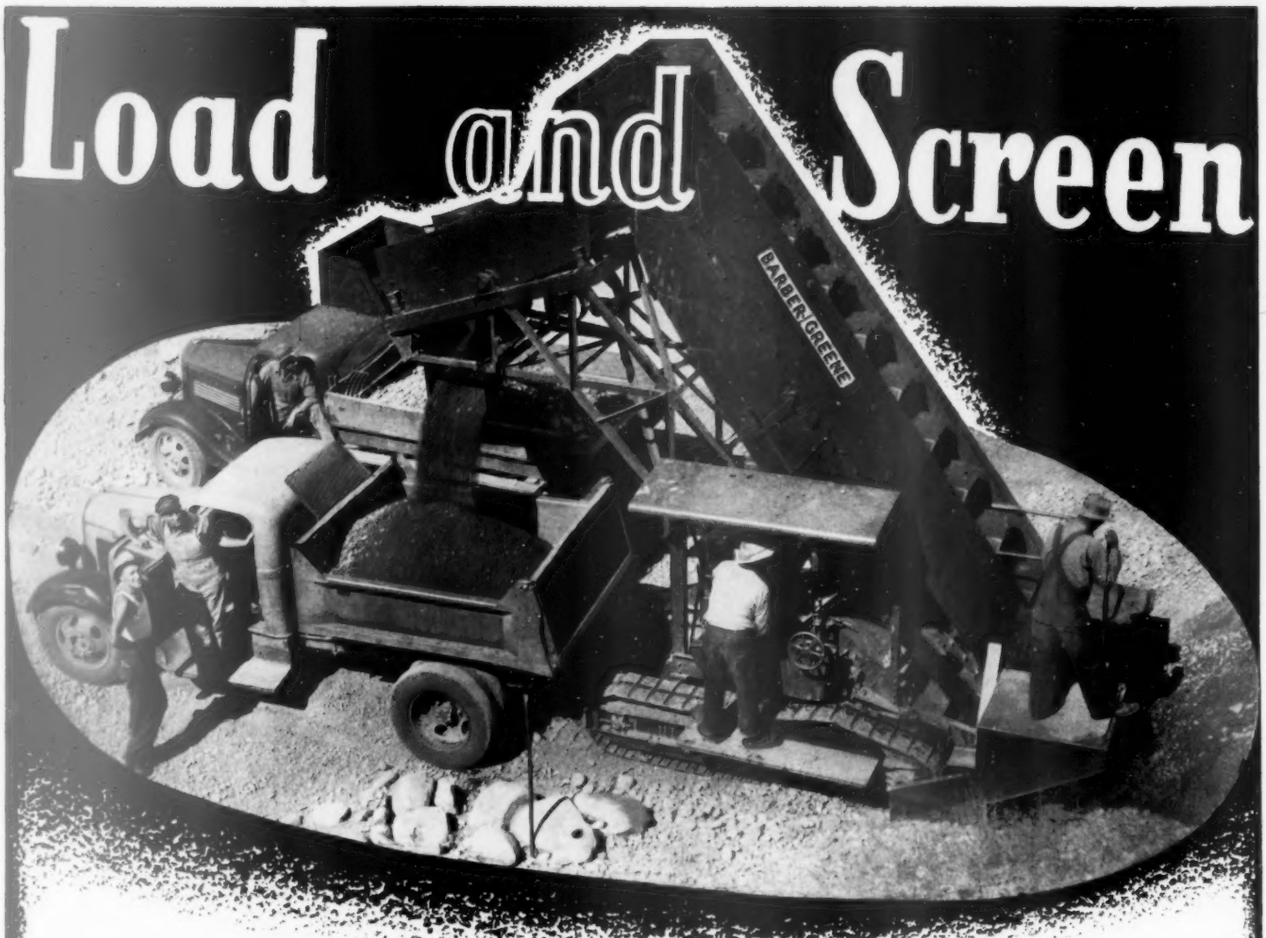

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BARBER-GREENE Bucket Loaders will load bulk materials from stockpiles to trucks cheaper than any other method.

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Bucket Loaders use less power, require less skill. They save truck time, man time, job time. They are used for loading, stripping, light excavating, unloading cars, etc. Their versatility makes them useful the year 'round.

Barber-Greenes with their Floating Boom, Automatic Overload Release, Tank Type Chassis, and other exclusive features are outstanding in quality, dependability, and ease of operation.

Write for full information on the High Capacity Model 82-A or the smaller, less expensive Model 552. There is no obligation.

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Vertical Boom DITCHERS
Low Cost-High Quality Road Construction

PIT AND QUARRY

CHICAGO AUGUST, 1939

Sec. Ickes Defends Permanente Contract

CALLED "BLOW TO COLLUSION"

Secretary of the Interior Harold F. Ickes has defended the award of the $11,025,892 contract for 5,880,000 bbl. of cement for the Shasta Dam in California to the Permanente Corp. as a blow against "collusive bidding" by other concerns on Federal projects.

The award for the largest cement order ever placed was made under a ruling by the comptroller-general that the Permanente firm, headed by Henry J. Kaiser, was eligible for the contract, despite the fact it had not yet constructed its plant. The bid was about $1,500,000 below those of seven other Pacific coast cement companies.

"I am heartily in favor of the Shasta contract," Sec. Ickes said. "This firm will be in a position to bid on other contracts as our big dams come along. Cement prices have been too high because we have not been getting competitive bids. We have been getting collusive bids!

"These companies have now run up against a man who is even willing to go out and build his own plant to get in on the bidding."

Favor Amendments to Public-Contracts Act

The Senate Committee on Education and Labor has reported favorably to the Senate the bill introduced by Senator Walsh (S. 1032) to amend the Walsh-Healey Public Contracts Act. The Committee made several important changes in the bill as originally introduced. The proposed amended version of the law provides that the Act shall hereafter apply to contracts or subcontracts with an agency of the Federal government in excess of or equal to $4,000; it would increase the penalty now provided for breach or violation of the stipulations required in contracts subject to the Act; and would create a blacklist of all persons or companies "found in a final adjudication by the appropriate court" to have interfered with the rights of employees to self-organization and collective bargaining.

The present Act applies only to contracts whose value exceeds $10,000, and subcontracting is not included except in respect to a provision which states that no part of the contract shall be executed under circumstances which are prejudicial to the safety and health of employees.

South Dakota Cement Plant Reports Profit

The South Dakota state cement plant commission at a recent meeting turned $150,000 into its interest and sinking fund, which now amounts to $2,400,000, Julius Sieler, secretary-treasurer, has announced.

The payment represents earnings during the past six months in excess of necessary operating expenses.

Outstanding bonds of the plant amount to $2,000,000 and interest on the bonds totals approximately $100,000 a year, Mr. Sieler said.

Members of the commission are Gov. Harlan Bushfield, Carl D. Johnson, Watertown, chairman; F. H. Hammitt, Armour; T. H. Johnston, Rapid City, and Mr. Sieler, Rapid City, secretary-treasurer.

Employment, Pay-rolls in Industry Rise

According to Isador Lubin, Commissioner of Labor Statistics, U. S. Department of Labor, employment gained 6.1 per cent. in quarrying and nonmetallic mining in May compared with April, while payrolls were up 10.6 per cent.

In the cement industry, employment gained only 0.4 per cent. in May over April while pay-rolls were 2.7 per cent. higher.

Seeks Permit to Dredge Gravel in Wabash River

The Youngman and Walsh Sand & Gravel Co. of Maunie, Ill., has applied to the United States War Department engineering office at Louisville, Ky., for permission to start dredging operations in the Wabash River. The dredging is to be done on the Illinois side of the river.

Advance Dates for 1940 Conventions

NCSA DIRECTORS IN SESSION

The 1939 annual meeting of the board of directors of the National Crushed Stone Assn. was held July 20, 1939 at the Westchester Country Club at Rye, N. Y. The meeting was well attended and most of the directors found time before and after the meetings to patronize the excellent golf, bathing and other amusement facilities available.

In the absence of T I. Weston due to illness, Otho M. Graves presided over the meeting. The roll call showed the following directors present: Messrs. Andrews, Bronson, Callanan, Couchman, Earnshaw, Graves, Hilliard, Kelb, Rainer, Rigg, Sanborn, Savage, Schmidt, Shotton, Shugg, Tomkins, Wills, Worthen, Rarey. Representing the Association were Messrs. Goldbeck, Boyd and Miss Beatrice Gray, who replaces Mrs. Bannerman, resigned, as Mr. Boyd's secretary.

L. Metcalfe Walling in his talk reviewed the first conference of representatives of these industries and the developments since. He also mentioned the possibility that the related industries will be dropped and only the crushed stone, sand and gravel and slag industries included. He also stressed the importance to his department of getting information on the prevailing rates of pay of all employees to give it a clear picture of the labor situation and make sound decisions possible. The proposed questionnaire, he said, has been adopted by the sand-and-gravel and slag industries. It was decided to add to the questionnaire a definition of the term "common labor". This question will be submitted to the industry by the association.

The board also voted unanimously in favor of continuing the annual exposition in connection with the convention.

Because of the American Road Builders' convention, the date of the crushed-stone convention in St. Louis was moved ahead a week to January 22 to 24. The sand-and-gravel convention has been moved ahead to January 17 to 19, 1940.

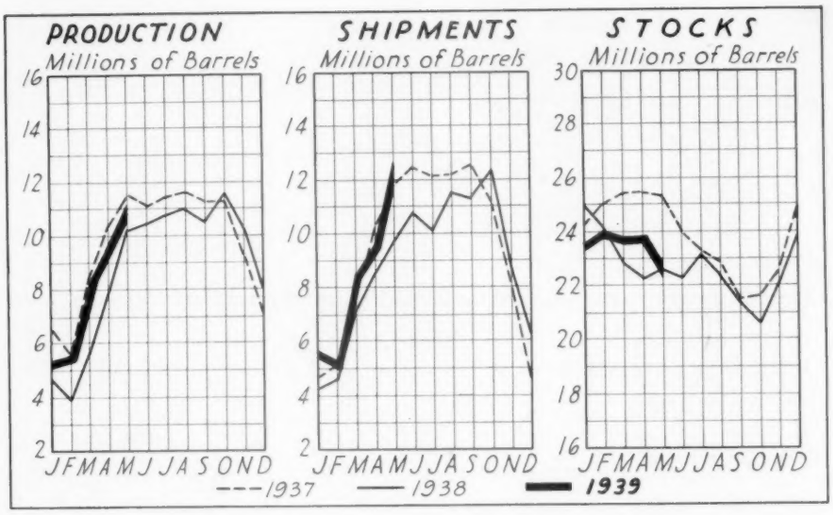
Residential Building Dollar Volume Rises

TOTALS HIGHEST SINCE 1929

Dollar volume of residential building contracts let during the first six months of this year was greater than for any similar period since 1929, according to F. W. Dodge Corp. In the 37 states east of the Rocky Mountains, the six months' contract total was $644,527,000, which was 61 per cent. greater than the total for the first half of 1938. and 25 per cent. greater than the total for the first half of 1937. Out of a $245,000,000 increase over the 1938 period, $181,000,000 represented the increase in private residential building and $64,000,000 measured the increase in public housing projects. All sections of the country participated in the residential building increases, with increments over the first half of 1938 ranging from 19 per cent. in New England to 125 per cent. in the Cleveland area.

Non-residential building also increased over the 1938 period, with a total of $516,579,000 compared with $433,220,000 last year. This was a 19 per cent. increase. In the non-residential classification, public contract volume increased 42 per cent. and private contracts increased 2 per cent. Heavy engineering contracts (public works and utilities projects) had a contract total of $538.258,000, nearly 17 per cent. greater than the corresponding 1938 figure. The combined result of all these building and engineering gains was a six-months' construction total of $1,699,364,000, a 31 per cent. increase over the first half of 1938.

Commenting on the construction record and outlook, the F.W. Dodge Corp. says: "Present indications point to a good construction volume during the remainder of the year, although comparisons with the corresponding months of 1938 will be less spectacular than in the past six months. The second half of 1938 was a period of steadily mounting volume after a slack period in the first half, whereas the month-by-month trend this year is following the more usual seasoned pattern. Residential building, both private and public, gives every indication of continuing at a satisfactory rate; non-residential building is likely to taper off somewhat due to lessened public expenditures. Heavy construction, largely supported by Federal funds, is also likely to continue tapering off. Even with an ever-narrowing spread between 1939 and 1938 monthly totals from now on, the year will probably close as the sixth consecutive one of construction volume increases."



The Portland-cement industry in May, 1939, produced 11,126,000 bbl., shipped 12,688,000 bbl. from the mills, and had in stock at the end of the month 22,275,000 bbl., according to the U. S. Bureau of Mines. Production and shipments of Portland cement in May, 1939, showed increases of 7.4 and 30.1 per cent., respectively, as compared with May, 1938. Portland-cement stocks at mills were 2.6 per cent. lower than a year ago. May, 1939, shipments were the best for that month in eight years and exceeded the May, 1937, shipments, the best previous May since 1931, by 798,000 bbl.

16 Regional Offices to Regulate Wages, Hours

A 16-region set-up for the Wage and Hour Division of the U. S. Department of Labor was announced July 1 by Administrator Elmer F. Andrews. Budget limitations, Mr. Andrews explained, will prevent the opening of all of these offices immediately, but plans have been completed for a mobile force of inspectors to service the entire country pending the full staffing of all regional offices.

Regional offices ultimately will be located in Boston, New York, Philadelphia, Richmond, Charlotte, Atlanta, Birmingham, Nashville, Cleveland, Chicago, Minneapolis, Kansas City, Dallas, Denver, Seattle and San Francisco. In addition to the Regional offices, eleven branch offices are contemplated.

Horace Stump, Cement Chemist, Dies at 51

Horace E. Stump, 51, for the last eight years consulting chemist and research director of the New England Lime Co., died July 11 in Sharon Hospital, Sharon, Conn., where he had undergone an operation.

A native of Chicago, Mr. Stump was graduated from Massachusetts Institute of Technology in 1910. He served overseas during the World War as a first lieutenant in the chemical warfare unit. After the war he was employed as a chemical engineer with the Kimberly-Clark Corp. and the New Jersey Zinc Co., and for a time was associated with the New York firm of Loomis, Stump & Banks.

He was a member of the American Society of Mechanical Engineers, the Tech Club of New York and Theta Xi. His wife, Mrs. Bertha Baldwin Stump, and a brother, Dwight Stump, survive.

New Rock-Wool Firm Formed in Indiana

A new mineral wool plant to operate at Lagro, Ind., has been incorporated under the title of Superior Insulations, Inc. The concern will manufacture and sell insulating materials, sound absorbing and control materials and other construction products.

Incorporators are William C. Davis and Joseph Dersher, Toledo, and Arthur D. Saborsky.

Lawrence Consolidates Managerial Positions

The position of plant manager at the Thomaston, Me., plant of the Lawrence Portland Cement Co., occupied for the last 10 years by C. H. Sonntag, has been consolidated with the position of manager of operations for both the Thomaston and Northampton, Pa., plants. This position will be held by M. S. Ackerman, Jr.

Enters Sand-and-Gravel Business at Madison

The Madison Sand & Gravel Co. has engaged in the washed sand and gravel business on Lake Madison, with headquarters in Madison, S. D., under the management of Edward Payne.

State Legislatures Complete Sessions

CALIFORNIA MEASURE KILLED

All but three of the 44 state legislative bodies that hold regular sessions this year had completed their work and adjourned by the time PIT AND QUARRY went to press, but in several other states executive action was awaited on measures that lawmakers had passed.

Legislative activity of the past month, state by state, follows:

California.—The House Committee on revenue and taxation on the final day of the session reported without action a bill proposing a tax on natural resources, resulting in death for the measure during the 1939 session. The bill sought to tax lime, limestone, silica and alumina used in the making of Portland cement at the rate of 15c. per bbl. of cement made from such materials; tax borates at the rate of $2.50 per ton; and all other natural resources severed from the land or water at the rate of 1 per cent. of their value at the quarry, pit, mine or other place of severance.

Illinois.—After giving it second reading, the House tabled a bill seeking to provide for a lien in the favor or material men and mechanics on the whole of the land or leasehold upon which the material was used or work done.

Missouri.—An effort to gain exemption for pit and quarry products used in the building industry from the state sales tax failed when the legislature refused to incorporate such exemption in the bill extending the state 2-per cent. tax.

The legislature gave final approval to a bill requiring all trucks transporting explosives to stop at railroad crossings.

New Jersey.—Still in committee was a House bill that would provide that a claimant for compensation for compensable occupational diseases shall file his petition within two years from the time such claimant ceased to be exposed to such occupational disease.

New York.—Governor Herbert H. Lehman signed into law a bill to provide that medical treatment rendered workmen disabled by dust diseases under the workmen's compensation law or, in lieu thereof, such hospitalization as may be allowed, shall be limited to 90 days which need not be continuous and such treatment may be extended on order of the industrial board for a period not to exceed 180 days instead of 90 days.

Ohio.—Two bills affecting the pit and quarry industry, although given favorable committee reports, failed to gain final passage. One sought to exclude dump trucks used in hauling gravel, sand, dirt, stone and road materials from the jurisdiction of the state public utilities commission, and the other would have authorized the sale of the state-owned Roseville brick plant.

Texas.—The legislature adjourned without passing the administration's proposed 2-per cent. natural-resources tax and retail sales tax.

Alpha Will Build 18 New Silos at Cementon

N. D. Colburn, eastern division superintendent of the Alpha Portland Cement Co., Easton, Pa., has announced that plans have been completed for the construction of eighteen new silos at the Alpha plant at Cementon, N. Y.

Nine silos were recently completed at the plant and with the new silos to be built will make a total of twenty-seven.

According to Mr. Colburn ten of the silos will be designed for storing the finished product and will hold approximately 65,000 bbl. of cement. The other eight will be raw-material, blending silos and will hold about 5,000 tons.

New Packing Plant at Green Bay, Wis., Opens

Several hundred business and civic leaders of northeastern Wisconsin attended an informal open-house program on Friday, July 7 at the Green Bay, Wis., packing plant of the Universal Atlas Cement Co., completion of which was announced by the company early in July. Operations at the new unit, said to be one of the most modern and efficient of its kind in the country, began Wednesday, July 5.

B. L. Busse of Green Bay, who was formerly at the company's Milwaukee, Wis., packing plant, has been placed in charge of operations at the Green Bay plant.

Work is now in progress on another packing plant for Universal Atlas at Muskegon, Mich.

Cement Contracts on Coulee Dam Awarded

PURCHASE 3,585,000 BARRELS

The procurement division of the U.S. Treasury Department has awarded contracts for about 3,585,000 bbl. of cement for Grand Coulee Dam.

The awards follow: Olympic Portland Cement Co. of Seattle, 697,000 bbl.; Lehigh Portland Cement Co. of Allentown, Pa., 450,000 bbl.; Northwestern Portland Cement Co. of Seattle, 245,500 bbl.; Superior Portland Cement Co., Seattle, 1,452,000 bbl.; Spokane Portland Cement Co., 250,000 bbl.; Santa Cruz Portland Cement Co. of San Francisco, 267,000 bbl.; Calaveras Cement of San Francisco, 89,000 bbl.

In addition, the following awards were made for low-heat Portland cement: 27,000 bbl. at $1.45 to Lehigh Portland Cement Co., and 135,000 bbl. at $1.45½ to Northwestern Portland Cement Co.

Gulf Appoints Clyde Bates to Sales Post

Gulf Portland Cement Co. announces the appointment of Clyde N. Bates, Houston, Tex., as assistant sales manager, effective July 1, 1939.

Mr. Bates has been associated with the cement industry in Houston and the Texas Gulf Coast area for the past 15 years. He was formerly with the Texas State Highway Department and the Portland Cement Assn. He is a native of Wharton, Tex., and a graduate of Texas A. & M. College.

Fire caused $5,000 damage when it destroyed a 1,000-gal. asphalt-storage tank and its contents at the plant of the Granite Rock Co. at Watsonville, Cal., a few weeks ago.

A storage bunker and conveying equipment were also damaged.

Motorship "Steel Chemist" delivering first cargo to the new Green Bay, Wis., packing plant of Universal Atlas Cement Co.

Inland Quarry Wins Top Safety Ranking

21 PLANTS ACCIDENT-FREE

The thirteenth annual safety contest conducted by the Bureau of Mines in coöperation with the National Crushed Stone Assn. which has just been completed, shows a decided improvement in the accident record of the enrolled companies as compared with that of the companies enrolled in the preceding year. All the enrolled companies were members of the Association.

Combined records covering 50 plants competing in the 1938 contest showed a reduction of 45 per cent. in the number of accidents and 58 per cent. in the number of days lost from accidents when compared with similar records covering the same number of plants in 1937, although the number of man-hours worked declined only 24 per cent. The accident-frequency rate for 47 open quarries and 3 underground mines enrolled in 1938 was 17.2 per million man-hours of employment, and the severity rate was 4.4 per thousand man-hours. Corresponding rates were 23.6 and 8.0, respectively, for 47 open quarries and 3 underground mines enrolled in 1937. The frequency rate in 1938 was the lowest and best on record during the 13-year period during which the annual safety contests have been conducted.

Since only a few underground mines are entered each year, it is not possible to compare the open-quarry group with the underground group for a single year. However, the average frequency-rate for open quarries over a 13-year period, was 22 per cent. lower than that for underground mines, and the average severity-rate was 11 per cent. lower.

The award for 1938 was won by the Port Inland limestone quarry in Mackinac County, Michigan. This plant, operated by the Inland Lime Stone Co., worked 299, 751 man-hours without a disabling injury.

A certificate of honorable mention was awarded to each plant, except the trophy winner, that operated during the year with an accident-free record. In addition to the winner, there were 21 such plants in 1938; 20 open quarries and one underground mine. The plants awarded these certificates were:

1. Krause No. 1 limestone quarry, Columbia, Ill., operated by the Columbia Quarry Co. (242,477 man-hours.)

2. Woodleaf granite quarry, Woodleaf, N. C., operated by the Raleigh Granite Co., a division of the Southern Aggregates Corp. (215,437 man-hours.)

3. Piqua limestone quarry, Piqua, O., operated by the Ohio Marble Co. (129,871 man-hours.)

4. North Branford No. 7 trap-rock quarry, North Branford, Conn., operated by the New Haven Trap Rock Co. (120,642 man-hours.)

5. Rolesville granite quarry, Wake Forest, N. C., operated by the Raleigh Granite Co., a division of Southern Aggregates Corp. (94,421 man-hours.)

6. White Haven sandstone quarry, White Haven, Pa., operated by the General Crushed Stone Co. (91,730 man-hours.)

7. LeRoy limestone quarry, LeRoy, N. Y., operated by the General Crushed Stone Co. (81,102 man-hours.)

8. Winchester trap-rock quarry, Winchester, Mass., operated by the General Crushed Stone Co. (77,874 man-hours.)

9. Marquette limestone quarry, Cape Girardeau, Mo., operated by the Marquette Cement Mfg. Co. (69,458 man-hours.)

10. Pixley limestone mine, Independence, Mo., operated by the Stewart Sand & Material Co. (53,245 man-hours.)

11. Jordanville limestone quarry, Jordanville, N. Y., operated by the General Crushed Stone Co. (51,833 man-hours.)

12. Union limestone quarry, Hillsville, Pa., operated by the Union Limestone Co. (49,958 man-hours.)

13. Gasport limestone quarry, Gasport, N. Y., operated by the Wickwire-Spencer Steel Co. (47,312 man-hours.)

14. Catskill limestone quarry, Catskill, N. Y., operated by the North American Cement Corp. (39,178 man-hours.)

15. Middlefield No. 1 trap-rock quarry, Middlefield, Conn., operated by the New Haven Trap Rock Co. (37,192 man-hours.)

16. Reidsville granite quarry, Reidsville, N. C., operated by the Raleigh Granite Co., a division of the Southern Aggregates Corp. (35,058 man-hours.)

17. Cheshire No. 6 trap-rock quarry, West Cheshire, Conn., operated by the New Haven Trap Rock Co. (31,794 man-hours.)

18. McCoy limestone quarry, Bridgeport, Pa., operated by the Warner Co. (24,483 man-hours.)

19. Rocky Hill trap-rock quarry, Rocky Hill, Conn., operated by the New Haven Trap Rock Co. (24,227 man-hours.)

20. Howes Cave Limestone quarry, Howes Cave, N. Y., operated by the North American Cement Corp. (18,645 man-hours.)

21. No. 4 trap-rock quarry, Knippa, Tex., operated by the Southwest Stone Co. (8,414 man-hours.)

Quality Lime Institute Adopts New Program

A reorganization of the membership and personnel of the Quality Lime Institute, with headquarters in Philadelphia, was recently effected. The membership is composed of lime manufacturers located in District 2 of the National Lime Assn. and the chief function of the organization is to promote among farmers the intelligent use of quicklime and hydrated lime for soil improvement.

Franklin S. Lee is general manager of the institute and its promotional staff includes Kenneth Hankinson and the part-time services of Henry A. Huschke. It is expected that the new program adopted will be effective in regaining agricultural-lime tonnage which was lost during the period when promotional work was suspended.

Investigate Trucking of Wisconsin Cement

HAULS LIMITED TO 70 MILES

General investigation of the transportation of cement by contract truckers, with reference to a competitive situation between Manitowoc, Green Bay and Marinette, was started by the Wisconsin public service commission at a public hearing at Madison, Wis., July 12.

The hearing was on the application of the Clipper City Transit Co., contract hauler for the Manitowoc Portland Cement Co. for lifting of the commission's ruling limiting truck hauls of cement to 70 miles. The Limestone Products Co. of Green Bay, Wis., opposed the application.

Cement shipped to Green Bay and Marinette by water is distributed within a 70-mile radius by trucks operating out of those cities, and the Manitowoc truck firm makes similar distribution from that city. The 70-mile limit, it is claimed, prevents free competition in the Green Bay and Marinette areas.

The limit was imposed as a safety measure, the commission has stated in upholding it on several previous occasions. With as heavy a commodity as cement, hauls longer than 70 miles should be made by rail and not on the highways, the commission has held.

Cement Employees at Hagerstown Picnic

Despite heavy showers, nearly a thousand persons attended the annual picnic of the North American Cement Co. in City Park, Hagerstown, Md. Entertainment, games, music and refreshments were furnished for the employees, their families and guests.

A brief address was given by John J. Porter, president of the company, who spoke of the importance of industrial safety work, particularly in the cement industry. Statistics were given, showing the number of lives saved as a result of accident-prevention campaigns. Employee and management responsibility was also stressed.

The picnic was in charge of the following committees: Entertainment, Hubert Troupe and C. J. Clipp; refreshments, John H. Zaiser and Milton Hines; softball, Paul E. Huffer and George Klick; general chairman, P. A. Leichel.

Sand Concentrates, Inc., owned by Holman & McFall, have opened a plant at 1168 Battery St., San Francisco, Cal., to handle sand to be used in sand-blasting work.

Buffington Workers Praised for Safety

PCA TROPHY IS REDEDICATED

More than 2,000 people including employees, friends, and customers of Universal Atlas Cement Co. and local civic leaders gathered at the company's Chicago plant at Buffington, Ind., on June 30 to celebrate an outstanding safety achievement of 1938. The occasion was the rededication of the Portland Cement Assn. safety trophy which the plant first won in 1934 and again in 1938 for completing a calendar year without a lost-time accident.

Speakers who praised the employees for the teamwork and coöperation necessary to establish the record were Prof. Frank C. Hockema, assistant to president, Purdue University; Frank T. Sheets, president, Portland Cement Assn.; Blaine S. Smith, president of the Universal Atlas company, and J. H. Kempster, general plant superintendent.

In his address, Mr. Smith praised employees for the teamwork and coöperation which had made possible the perfect safety record in 1938, and announced that the trophy rededication was the twenty-seventh of its kind to be held at the company's plants. In discussing the type of teamwork that exists at the Buffington plant, he said, "Here at Buffington we have a happy family group. It is portrayed by the service record of employees. There are in the audience today a number of persons who have worked with the corporation for a quarter of a century or more and who have now retired on pensions. A great many of you who are active employees have had 15 to 20 years of service. The average for all employees at Buffington plant is over 10 years and those with the rank of foreman and above have an average service record of more than 22 years."

Mr. Smith paid special tribute to the outstanding safety records of two Buffington plant employees. "We have two men here at Buffington," he said, "who have spent more than 34 years in this plant—John Kluga and John Skuta, and during this long service they have never lost any time because of accidents. Theirs is an enviable record."

Vice-president P. C. Van Zandt congratulates John Kluga and John Skuta each of whom has worked 34 years without an accident.

New Use Is Discovered for Blasting Machines

Blasting machines are portable hand-operated dynamos with electrical characteristics especially designed for firing blasting caps. These compact and reliable little power plants are a most effective accessory to electric blasting.

Although they are made for the express purpose of firing electric blasting caps, they are suitable for any operation requiring short spurts of current at random intervals, and they are dependable and will give long service. A large coal mine, the *Explosives Engineer* points out, recently adapted them to a unique use which no doubt will be of interest to other operators. This mine uses 10-cap blasting machines as a source of current for ringing signal bells in a large conveyor system.

Many blasting machines are used in the signal system, and the mine reports that they are admirably adapted to this work. Through their use the signal system has been made very flexible. With blasting machines as a current source, permanent lines carrying current are not necessary. An added advantage is that they can be readily moved about with the conveyor. Miners in the rooms signal the men at the source of power at the other end of the conveyor simply by twisting the handle of the machine an appropriate number of times. This system is used all over the mine, and has proved very efficient and trouble-free.

Lime Convention to Be in Chicago Next Year

At its meeting on June 1, in Hot Springs, Va., the new Board of Directors of the National Lime Assn. decided upon Chicago as the site of the 1940 annual convention of the association. Preference was expressed for the Drake Hotel where the convention was held in 1937. The tentative time selected was the third or fourth week of May, final dates to be decided later after contacting the hotel management.

A fire of unknown origin recently destroyed the Williams-Schneider crushed stone plant southwest of Springfield, Mo. Loss probably will exceed $10,000. The blaze originated in the roof and smouldered for several hours before it burned itself out.

Heavy crushing machinery in the top part of the building was ruined when it crashed through the top floor.

Motorists Pay 40% of All State Taxes

ADDITIONAL IMPOSTS LEVIED

According to the National Highway Users Conference, a recent report shows that motor-fuel taxes represent 29 per cent. and registration fees 9.5 per cent. of all revenues collected from state taxes during 1937. Combined, these two special taxes, collected almost solely from the highway users, represented approximately 40 per cent. of all state tax revenues. Some of the 1939 state legislatures levied additional imposts on highway users and proposed increases are still pending in other states.

Additional highway user taxes were levied in Minnesota, Florida, New York, Ohio, Pennsylvania and West Virginia. Increases in highway user taxes were rejected by Arkansas, Georgia, Indiana, Kansas, Maine, Oklahoma, Tennessee and Vermont, while bills to reduce the gasoline tax failed in Arizona, Arkansas, Connecticut, Delaware, Indiana, Minnesota, Oklahoma, Rhode Island, South Dakota, and Tennessee.

In addition to the four states having constitutional provisions prohibiting diversion of highway users taxes to purposes other than the construction and maintenance of highways (Kansas, Colorado, Missouri and Minnesota), California, Michigan and New Hampshire adopted anti-diversion amendments at the last general election. During the present legislative year, Idaho, Iowa, South Dakota and Wisconsin took initial legislative action to provide for a constitutional amendment against diversion of highway tax revenues and Nevada took the necessary second legislative action to place such an amendment before the electorate. The Iowa and Wisconsin resolution must be passed again by succeeding legislatures. Similar resolution failed in Arizona, Connecticut, Indiana, New Mexico, Oregon, Rhode Island, and Utah. They are still pending in Delaware, Florida, Massachusetts, Missouri, Pennsylvania and Texas.

North Dakota reënacted its present anti-diversion statute; such a bill failed in Indiana, and the one in Wisconsin is still pending. Actual diversions were defeated in many states, including Montana, Oregon, Tennessee and Washington; but the cause of stopping the diversion of highway funds received a severe blow in Delaware which abolished its highway fund and incorporated it into the general fund.

Diversion of highway funds to totally unrelated purposes reached an all-time high in New York state where the diversion totalled about $75,000,000.

EDITORIAL

Freedom in Industry

THE Congress of the United States has been asked to consider a new legislative proposal, known as the O'Mahoney bill (S. 2719), designed to command a higher respect for the existing anti-trust laws. It seeks to widen the scope of those laws by providing that "any violation of any provision of the anti-trust laws by any company shall be a violation of such provision by each officer or director of such company who shall have done, or authorized, ordered or caused to be done, any act constituting in whole or in part such violation." The bill provides further that "any officer or director of any company . . . if he shall have had knowledge of any act constituting in whole or in part such violation, shall be presumed to have authorized, ordered or caused such act."

To those who have been demanding that teeth be put in the anti-trust laws this bill should prove satisfactory. By reducing the number of loop holes in existing laws, by stopping the gap through which it has been possible to disclaim responsibility and escape punishment, by increasing the severity of the penalties for violations of them, by ceasing to treat corporations as legal entities rather than as aggregates of individuals, this bill, if enacted into law, would place squarely on the shoulders of every business executive of importance the duty of guiding his company in the direction of competitive fair play.

To certain types of business men, especially those who for special reasons desire to lead their companies along different lines, the O'Mahoney bill is just another of those legislative thorns which modern governments are thrusting into the sides of business. To them it represents another intrusion, another encroachment, a new policing of industry in the interest of social reformers and political "crack-pots." Those who have elected themselves to act as spokesmen for business men as a class seem to be unduly alarmed lest this new bill become law and impose its restrictions upon business men who act legally as well as upon those who act illegally.

We have long believed—and within recent years we have often heard it said—that most business men are honest and law-abiding. Organizations of business men have repeatedly and vociferously proclaimed the fact, and the dealings of most people with many classes of business men have convinced the public at large that honesty is no less common a quality among business men than among professional men or men in other walks of life. Yet now the National Association of Manufacturers seems to hold a less confident view for in its recent letter to members describing the O'Mahoney bill and its provisions, Walter B. Weisburger, its executive vice-president, says: "Every business man should carefully consider the effects of the proposed new legislation upon himself and upon his business." Why "every" business man—the law-abiding as well as the law-violating—should be particularly mindful of the "effects" of the proposed law upon "himself" and "his business" is rather difficult to understand. Law-abiding business men will have nothing to fear from the O'Mahoney proposal; their acts and those of their companies will be beyond the attention and scope of its provisions; their practices, deemed lawful until now, will not suddenly become unlawful through the passage of this bill.

The association's chief fears seem to arise from an alleged inability on the part of the average business man to determine what is legal and what is illegal. These fears are said to be somewhat increased by a recent statement of Assistant Attorney General Thurman W. Arnold, who said that "The boundaries of the application of the law [the anti-trust laws] to every industry is yet to be determined." The O'Mahoney proposals do not add to the number or kinds of acts that are illegal under the anti-trust laws; any uncertainty that may exist concerning the legality of a contemplated act on the part of a business man is not increased by the proposed amendment. No law-abiding business man has anything more to fear, in our judgment, because of the possible passage of the O'Mahoney bill; the conduct of his business in legitimate ways will not be made more difficult; his standing in the eyes of his customers will not be affected in any way. The proposed law merely fixes the civil and criminal responsibility of corporation directors and executives; it makes it incumbent upon every responsible business executive to see that he remains within the law in his decisions with respect to policies affecting his competitors.

LIBERTY—freedom of choice and action, freedom of thought and of speech—is one of the cornerstones on which democracy has been erected. It gives the individual the greatest latitude ever made available under any form of government known to man. It encourages the development of initiative, the expansion of thought, broadening of the scope of discussion, widening of the field of action. These are opportunities of which every business man takes, or seeks to take, advantage. They have made business possible; they have enabled it to become great.

No social distinctions sanctioned by law have prevented men from stepping out of obscurity into the realm of greatness. Certainly business has drawn its greatest individuals from the lower social strata.

No legislation or court decisions have prevented men from exercising their ingenuity, from projecting new

ideas, from astounding the world with proposals of great daring. The business man profits continually from the free exercise of his right to free thinking.

No legal code has denied to men the privilege of speaking and writing freely of what was in their minds, even when those expressions were adversely critical of the very government which made them possible. Without advertising, written and spoken, the opportunities for business expansion and profit could not have become what they are.

No governmental edict prescribes the sphere within which a man may exercise his talents. Business men have expanded their activities from one field to another, from related lines to lines only remotely related to their own, without hindrance from the law.

BUT these rights carry with them certain responsibilities; that is one of the characteristics of freedom. One can not enjoy a right without having at the same time a duty. On that foundation is built the entire structure of Anglo-Saxon law. This principle has given us a degree of freedom that has been unknown where that fundamental truth is ignored or denied. It has given us, too, the duty of respecting the rights of others, of exercising our own rights so that we do not trespass on the similar privileges which others enjoy.

Our laws, therefore, tell us in general terms what types of acts are, in the interest of justice and fair play, unlawful. They forbid the attainment of certain results or effects, but they have little or nothing to say about the means. Laws forbid murder, but they do not enumerate the thousands of ways in which it can be accomplished. Our anti-trust laws forbid monopolizing and "unfair methods of competition," but they do not enumerate the many ways in which monopolizing can be done or the thousands of acts that constitute unfair competition. Even certain types of business men and lawyers, who busy themselves endeavoring to devise new ways of circumventing the law, could not compile a complete list of the multitudinous methods that might be used to embarrass, damage or destroy a competitor. Law-makers, no less than the rest of us, are limited in vision and in their ability to see into the future; their laws must, therefore, be statements of principles, not catalogs of methods and machinery.

Even if it were possible to itemize in every law the many possible ways of violating it, it is questionable if it would be desirable to do so. Our legal traditions are opposed to such a method, and the law is one field of activity where traditions as exemplified by precedents define the infraction and the penalty. The ability of each man to stand on his own moral responsibility, to decide for himself the rightness or wrongness of his contemplated acts, and to pay the penalty if he makes the wrong decision is the bulwark of individualism and personal liberty. When we renounce that, we open the door to authoritarianism, under which the rightness or wrongness of an act is determined, not in accordance with a sense of justice, but in accordance with dictatorial precept. And in such a scheme we have the orders of bureaucrats to compel compliance, rather than individual sense of right under the law to serve as a guide.

As long as competition in business can be kept reasonably free—that is, reasonably free from the dictation and control of groups bent on the damage or destruction of their competitors—business men can continue to think and act with the degree of freedom to which they have become accustomed. When enterprise characterized by such freedom of choice and performance disappears, control by government must enter. We may have our choice between the checks on aggressively-destructive combinations of business provided by normally free competition and the restrictions placed on all business enterprise by government control. As the conditions of free competition disappear one by one, government regulation steps in little by little, until, as we have seen in Germany, despotic centralized authority manages everything.

The maintenance of an economic system in which freely-competitive enterprise is the central principle can not be left to chance; our present anti-trust laws are evidence of that fact. And, despite the growth of mass production in this country, there is no evidence to prove that tremendous combinations destructive of true competition in business are essential to meet the conditions of the day. In fact, mass production could not long exist without the stimulating effects of competitive price policies. The ability to compete freely with one another is still as essential to the growth and soundness of business enterprises as it ever was, yet that ability is continually being lessened by the increasing dominance of certain powerful factors in all major industries.

THE great majority of business men are essentially honest. They expect no more in the way of financial reward that their ability to serve will earn in a system where free competition exists. They favor a strengthening of the anti-trust laws in any way that will increase their security by guarding them from control by industrial monopolies. They have nothing to fear from a stiffening of existing legislation. In fact, they welcome it as a means of preventing or, at least, deferring, the arrival of the time when unbridled monopolizing of industrial enterprise may reach such a point as to make centralized governmental control unavoidable. They prefer to retain our present system of protective legislation with the guarantees provided by a constitution interpreted by a judicial system that acts as referee. They are willing to assume the risks of choosing the wrong and unfair path in their dealings with their competitors and of paying the penalty for their mistakes, rather than submit to administrative tribunals with sufficient autocratic power to tell them in advance what they can and can not legally do. They still prefer, we believe, the uncertainties of industrial freedom to the positiveness of governmental despotism.

Volume Changes in Mortars, Strength of Brick Masonry Among Technical Problems Discussed as N.L.A. Meets

TECHNICAL problems occupied the attention of those who attended the twenty-first annual convention of the National Lime Assn. at Hot Springs, Va., June 1 and 2. The volume changes that occur in mortars, the strength characteristics of brick masonry, and the effects of lime in mortar and concrete were the subjects discussed by men who have devoted many years to the study of the questions involved.

Forty-three representatives of 26 lime-manufacturing companies attended the convention. They came from 11 different states—11 from Pennsylvania, 10 from Virginia, 6 from Tennessee, 5 from Ohio, 3 from Florida, 2 from Illinois, and 1 from each of Alabama, Louisiana, Massachusetts, Missouri and Wisconsin—and Canada.

Volume Changes in Masonry Mortars

Howard R. Staley, of the Masonry Materials Laboratory of the Massachusetts Institute of Technology, reported in detail the results of many tests made in his laboratory of factors affecting the volume changes in mortar and the strength of brick masonry.

Mr. Staley's report was in two parts, the first of which dealt with volume changes of masonry mortars and the second with the strength of masonry. On the former subject he said:

"Beyond any reasonable doubt the volume changes of masonry mortars occurring subsequent to hardening are the most destructive agents in the rupture of the bond between the brick and the mortar. Since thermal changes are small for both the unit and the mortar and changes in moisture content cause very small changes in the unit, the most important factor is the volume change due to a change in moisture content of the mortar.

"The petrographic study of the bond of old specimens of brick and mortar showed, in every instance studied, that a rupture of the bond had occurred where high-cement mortars had been used and that maintenance of the bond was a common factor with high-lime mortars. The reasons for these facts will perhaps be more apparent later.

"Professor Voss has previously reported the effects of varying fineness moduli of sand upon the volume changes of various mortars. In this particular series, which has progressed through the tenth cycle, the effect of richness of mix upon volume change was studied. The fineness modulus of the sand used was 2.27. Both dolomitic and high-calcium hydrates, added dry and after being soaked for 72 hr., and dolomitic and high-calcium putty, aged 72 hr. after slaking, were used in the mortars. The proportions, by volume of lime-solids, were restricted to those most commonly used in masonry mortars. The cement used was a standard Portland cement. Readings were taken with a 10-in. fulcrum-plate type of strain gage, reading to 0.0001 in., on 1½-in. square bars, which had been cast in water-tight metal molds. The first reading was taken at 48 hr., as the volume changes occurring previous to this time are not as important with the lime-cement mortars, being most important with the straight-cement mortar with its inherent and quickly attained rigidity. . . .

"It is known that the volume changes of mortars cast in absorbent molds are different in magnitude from those cast in non-absorbent molds, but that does not alter the fact that no matter what type of mold is used, the values obtained are relative values for the particular conditions imposed. The only way that the exact magnitude of volume changes can be measured is to take measurements on masonry walls during construction in the field. . . .

"If a mortar is plastic and workable, has a high-water-retaining capacity and can remain in a semi-plastic state for a period of time in order for consolidation to occur with the additional load of the wall, and this consolidation occurs after some loss of water to the unit, then the mortar is densified and becomes less susceptible to volume changes due to changes in moisture content, because it is less absorbent. The lowering of the water-cement ratio by the absorption of water by the brick during consolidation and prior to cementing action would tend to lessen the magnitude of subsequent volume changes and would also tend to increase strength. High-lime mortars can benefit by the process of consolidation, due to the added wall load, in a much greater degree than high-cement mortars because they possess the qualities outlined above.

"While mixing these mortars an attempt was made to judge correct sanding by working with the trowel. While admittedly a crude test, judging of correct sanding with the trowel is not impossible. For the mortars containing slaked lime-putty the proportions for correct sanding, for the sand used, were 1C-1L-6S and 1C-2L-9S. The 1C-1L-5S mortar was on the rich side and the 1C-1L-6.5 mortar was slightly over-sanded. The mortar of proportions 1C-2L-7.5S was quite "sticky" and the 1C-2L-10.5S was definitely over-sanded; even though being quite workable.

"The mortars made with the dry lime hydrate in the proportions 1C-1L-5S and 1C-2L-7.5S appeared to be about correctly sanded. There is some improvement of sand-carrying capacity with the soaked hydrates, the improvement being more marked with the soaked dolomitic hydrate.

"It is more difficult to judge the sand-carrying capacity of a cement mortar because the mortar retains its more-or-less harsh feeling under the trowel even with very rich mixes. It is fairly certain, however, judging by this method, that the 1C-0L-2.5S mortar is not under-sanded. No doubt there have been many walls built using mortars with sand contents as high as the poorer mixes used in this investigation, but the practice of over-sanding can not be condoned, under any consideration. . . .

"It had been noted in a previous investigation by the author that the point of maximum workability for lime-cement mortars was quite critical to small additions of water and that the cement mortars required a higher water content, per volume of cementitious material, to be classed as workable. These latter mortars also invariably had a higher flow and were not nearly so

sensitive to small additions of water. Referring to the accompanying table, it will be seen that a lower flow is required in every instance for maximum workability under the trowel, for the mortars made with slaked-lime putty. The above statement is not quite so true for the mortars made with lime hydrate, but even for these the average flow is lower.

"It should also be noted that, generally speaking, there is less variation in the two flow figures for the lime-cement mortars than with the straight-cement mortar. This can be accounted for by the difference in cohesive properties of the materials. Time is a more serious factor for consideration in the case of the flow of the straight-cement mortar. In the wall time is an even more serious factor for the cement mortar, due to its low water-retentivity."

Although the difference is small in some cases, according to Mr. Staley, the straight-cement mortar shows the largest growth for all mortars, except those made with the dolomitic hydrate. There is little difference between the mortars made with the slaked quicklime, he said. The mortars made with the dry high-calcium hydrate show less growth than those made with the high-calcium putty and those made with the high-calcium soaked hydrate show the least growth. Those made with the dolomitic hydrate showed the largest growth during this period and soaking the hydrate tended to reduce the change. There is no consistent effect of richness of mix shown with any of the mortars during this period.

"Speaking generally," he said, "the mortars made with the high-calcium putty had the greatest shrinkage during this period. The straight-cement mortar had the next greatest shrinkage with the exception of one rich mix with the dolomitic putty. The mortars made with the high-calcium hydrate, both dry and soaked, show less shrinkage than mortars made with the high-calcium putty, and the dry dolomitic-hydrate mortars rather consistently show less shrinkage than the dolomitic-putty mortars. The effect of high sand content is rather marked, in that all the highly-sanded mortars show less shrinkage than the richer mixes."

Over a period of from 2 to 168 days of curing and drying the dolomitic-hydrate mortars showed the least shrinkage due to the relatively larger growth during the curing period, according to the speaker. The residual shrinkage for the straight-cement mortar is reduced for the same reason. The high-calcium-putty mortars show the largest amounts of shrinkage, and the low shrinkage values during the drying period for the highly sanded mortars is reflected in the cumulative changes.

"All the lime-cement mortars have volume changes of less magnitude than those of the straight-cement mortar, with the poorer mixes exhibiting the smallest changes. Of the lime-cement mortars only one, the 1C-2L-7.5S mortar made with dry hydrate, does not exhibit a residual shrinkage at the end of the tenth cycle. The poorer mixes with the dry hydrate and the two mixes with the soaked hydrate show the largest amounts of residual shrinkage. For the cement mortar the rate of change during wetting remains about the same, while during the drying

Proportions on Basis of Lime Solids C-L—S	High-Calcium Putty *Flow (%)		Dolomite Putty Flow (%)		Dry High-Calcium Hydrate Flow (%)		Soaked High-Calcium Hydrate Flow (%)		Dry Dolomite Hydrate Flow (%)		Soaked Dolomite Hydrate Flow (%)		No Lime Flow (%)	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
1-0-2.5													80	85
1-9.88-5	72	75	69	72	81	80			78	80				
1-1-5	74	75	74	69	80	80	78	80	80	84	80	80		
1-1-6.5	75	75	72	72	85	87			80	81				
1-1.76-7.5	69	72	71	75	80	80			81	82				
1-2-7.5	69	72	72	69	75	78	77	78	80	80	77	80		
1-2-10.5	73	72	75	72	84	84			80	76				

* *Flow* (1) Dropped ½ in., 25 times in 15 sec.
(2) Dropped ½ in., 15 times in 15 sec.

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1939

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period there is a tendency for the rate to decrease during the tenth cycle. For the lime-cement mortars there is a tendency for the volume change to occur in a shorter period during wetting and these mortars seem to stabilize more rapidly after wetting. These tendencies are significant, when viewed from the standpoint of water-tight masonry. The volume changes for the poorer mixes are rather consistently less than those for the richer mixes, though the difference is not marked.

In all cases the volume changes for the lime-cement mortars during wetting and drying cycles are one-half or less than those shown for the straight-cement mortar, Mr. Staley explained. The lime-cement mortars without exception show some residual shrinkage at the end of the tenth cycle and the mortars with the highest lime content and the highest sand content exhibit the smallest volume changes in this group. There is little difference between the mortars made with dry or soaked hydrate. The stabilizing effect of the lime is more marked with the higher lime content in the richer mixes.

There is considerable similarity between the rates of change of these mortars and those made with the dolomitic hydrate. The curves for the lime-putty mortars are quite generally displaced downward from the initial line a small amount more than the hydrate mortars, the exceptions being the poorer mixes. The smallest changes consistently occur with these latter mixes. The magnitude of the changes for the lime-cement mortars is less than that for the straight-cement mortar.

The same tendencies, as to small changes and rapid stabilization, he added, are exhibited for this group of lime-cement mortars as for the others. After ten cycles a very small amount of residual shrinkage is shown for all mortars except the poor mix (1C-2L-10.5S). The effect of richness of mix is quite marked for these mortars, the poor mixes consistently showing the least change.

"Considering the group of mortars, as a whole," he continued, "there is a distinct tendency for most of the lime-cement mortars to reach an equilibrium condition more quickly than the straight-cement mortar. If the volume changes for the lime-cement mortars were large, the extensibility of adaptability were less, and the inherent faculty for autogenous healing were not present in a high degree, then the rapid changes in the lime-cement mortars might do much harm in promoting disintegration due to stress changes. The general trend of the lime-cement mortars is the reduction of magnitude of change with age. The same tendency exists to a certain extent with the straight-cement mortar. The most plausible explanation for the lime-cement mortars is upon the basis of the carbonation of the lime, thus creating a material not so susceptible to moisture changes. What reduction there is in magnitude of change for the straight-cement mortar can be explained on the same basis, as during the hydration of the cement a small amount of lime is produced and the carbonation of this lime exerts an influence toward stabilization and reduction of the magnitude of the volume change."

Mr. Staley's data warrant the following conclusions, in his opinion:

1. Of the proportions studied, lime-cement mortars have higher rates of change than straight-cement mortar for all periods.

2. Higher sand contents of mortars tend to reduce the magnitude of the volume changes during all periods.

3. The lime-cement mortars studied have smaller volume changes during wetting and drying cycles than straight-cement mortar.

4. Lime-cement mortars reach a condition of equilibrium more rapidly under any of the types of exposure studied.

Discussing the question of the strength of masonry, Mr. Staley said in part:

Factors Affecting Masonry Strength

"Some agencies now require the strictest adherence to certain qualifications for laboratory tests of the individual materials and are prone to forget that the materials are not used in construction as they have been tested. The illusion still exists, in certain instances, that all the results obtained in the laboratory are duplicated in construction. . . .

"Increasing the cement content will make the actual water requirements on the job larger, for this will increase the tendency for the mortar to set on the board before it can be used. It is well known to any practical mason that the mortar which will require the largest additions of water in order to keep it workable, after mixing and before being consumed, are the mortars of high cement content. Additions of water raise the water-cement ratio and thereby reduce the strength of the mortar. The requirement of the above change may, therefore, have actually defeated the purpose. . . .

"It has often been a source of wonderment to me as to why some of the buildings I have worked on, many of them wall-bearing jobs built with mortar made with lime putty, gaged with 2 sacks of cement to 1 bbl. of quicklime, did not deteriorate due to freezing and thawing, or collapse because of insufficient strength. The proportions of the above mortar would be approximately 1 cement to 3.6 lime to 12 parts of sand by volume. This kind of mortar would do well to test 150 p.s.i. at 28 days, and freezing and thawing tests would no doubt prove that it would not stand up in use. The fact remains, however, that the buildings are giving satisfactory service, are not deteriorating and walls are water-tight."

From his studies Mr. Staley said that:

"To me strength in masonry is a factor to be considered only after the other qualities of the combination of materials have been considered. Simply because a brick has high strength would not influence me to accept it as satisfactory. There are other characteristics I would like, namely, a medium total absorption, a satisfactory rate of absorption, soundness, homogeneity, absence of shrinkage and burning cracks, regularity of size, etc. Simply because a mortar has a strength of 1,000 p.s.i. would not influence me to accept it for masonry work on that basis alone. There are other qualities, besides high strength in a cylinder, that are very desirable in a mortar, chief among them being, workability and plasticity, which directly affect the workmanship and determine the degree of continuity of contact between the brick and mortar; bond-forming ability, initially and over a period of years, which is an inherent quality of high-lime mortars and affects the degree of water-tightness; water-retaining capacity, which affects the degree of early attainment of rigidity, thereby affecting the amount of densification due to consolidation; and, finally, volume changes subsequent to hardening, which affect the permanence of the bond between the mortar and the unit. Intelligent selection of materials for masonry can be based on the characteristics of the individual materials only after we realize how these affect the assembling of the wall and the characteristics of the final assembly over a period of years."

To further our knowledge of strength characteristics, compression tests of various combinations of masonry materials were made, and Mr. Staley presented the data obtained from them. The average mortar-cylinder strengths for all mortars were found to be as follows:

Average 2-in. by 4-in. Cylinder Strengths (p.s.i.)

Proportions C-L-S	28 days	3 months	6 months	Ratio 6 mo./28 days
1-0-2.5	3,000	4,660	5,290	1.76
1-1-5 Dol.	1,455	2,390	2,650	1.82
1-1.5-6.25 Dol.	920	1,720	2,087	2.27
1-2-7.5 Dol.	785	1,640	1,900	2.42
1-1-5 H.-C.	1,020	1,585	1,995	1.95
1-1.5-6.25 H.-C.	576	1,078	1,285	2.23
1-2-7.5 H.-C.	380	736	845	2.22

"The average straight-cement-mortar cylinder strength is higher at all ages," he said, "but these cylinders have the lowest increase in strength at 6 months. The lime-cement mortars made with the dolomitic lime consistently show higher strength than those made with the high-calcium lime at all ages, and the percentage increases average about the same for the mortars using the two limes. It is interesting to note that these increases in mortar-cylinder strengths are not exactly reflected in the pier strengths, the rate of increase in strength being higher for the cylinders."

Referring to the tests of piers and cylinders, Mr. Staley pointed out that:

"There is no definite correlation between the strength of the pier and the strength of a cylinder with different mortars, and it appears that the weaker the mortar in the cylinder test, the higher the strength in the pier in proportion. That is, the potential masonry-strength value of a mortar can not be judged by the strength of a mortar in a cylinder. The lowest strength mortars, those made with the high-calcium lime, quite generally show the largest gain in strength in the piers. To assume that the strength of the mortar in a cylinder is reflected in the masonry is entirely fallacious.

"The same general tendencies exist for both piers and assemblages. In all instances the pier strengths are higher at 6 months than at 28 days, but there is no consistent relationship. The assemblages, except in five instances, also have higher strengths at 6 months than at 28 days. The smallest increases in strength for both are with the No. 5 brick which gave the highest 28-day strengths. The average increase in the ratio, 6-month strength to 28-day strength, is larger with the piers than with the assemblages, as would be expected, due to better conditions for curing existing in the piers. . . .

"If high compressive strength were the only criterion for the selection of a mortar, the straight-cement mortar would be chosen, but the degree of uncertainty as to the ability to duplicate the workmanship of these piers in an actual wall with the straight-cement mortar is much greater than with the lime-cement mortars due to the harsh-working characteristics and the lack of plasticity of the straight-cement mortar."

In actual construction, the speaker said, the compressive strength of the masonry would probably exceed the values found for these piers, due to the consolidation resulting from the added weight of the masonry. This increase could be expected to be higher with the lime-cement mortars, due to the fact that they remain in a semi-plastic state for a longer period, than the straight-cement mortars and therefore could benefit more from consolidation. There is no question but that this consolidation is also a factor in the weather-tightness of walls.

The following conclusions are based on the data presented by Mr. Staley on the strength of masonry:

1. The requirement that strength tests for masonry materials be made on the combination of brick and mortar to be used is a logical and sound basis for selection.

2. The requirements that the

$$\frac{\text{Strength of "two-bat" assemblage, at 28 days}}{8} = 150 \text{ days or over}$$

and

$$\frac{\text{Strength of "two-bat" assemblage at 28 days}}{\text{Strength of mortar cylinder at 28 days}} = 1.25 \text{ or over}$$

is a conservative basis for the selection of masonry materials, according to the results obtained in this study.

3. Lime-cement mortars of the proportions, by volume, used in this study, namely, 1C-1L-5S, 1C-1.5L-6.25S and 1C-2L-7.5S, attain adequate strength in a solid-brick wall, where the allowable design load is 150 p.s.i.

4. The strengths of brick piers do not vary directly with the compressive strength of the brick.

5. The strengths of brick piers do not vary as the strength of the mortar in a 2-in. by 4-in. cylinder.

Discussion by Harry Plummer

The discussion of Mr. Staley's paper was led by D. E. Parsons, chief of the Masonry Construction Division, National Bureau of Standards, whose remarks, owing to failure of the bureau to grant permission for their publication, can not be printed at this time. Mr. Parsons was followed by Harry C. Plummer, chief engineer of the Structural Clay Products Institute, who opened his comments on Mr. Staley's discussion by saying:

"Since I must of necessity bring to this discussion the viewpoint of the engineer, permit me to point out that while the architect or the engineer frequently is short on theory, he often is very long on experience and, unless the results of research can be correlated with the knowledge which he has gained from his experience, often at considerable expense, he will be a hard man indeed to convince. It should be borne in mind also that the engineer's interest in the more-or-less academic facts relating to materials is at best a casual one, but that he is very much interested in the performance of materials as related to the life and serviceability of his structures and in cost. I do not mean to imply by this statement that research should be restricted to a narrow field; complete knowledge of a material is essential to the technician who hopes to improve its quality or to develop new uses for it. Finally, however, research must be related to service conditions and the results presented to the architect or engineer in a form adaptable to his use. His interest primarily is in the masonry, and he is constantly on the alert for masonry materials which will contribute to the resistance to moisture penetration, the durability, strength, and appearance of the finished structure."

Recently Mr. Plummer prepared a pamphlet on mortar for the Structural Clay Products Institute in which three mortar-mixtures of cement, lime, and sand are recommended for general use, as follows, all proportions being by volume:

(1) *1 cement; 1 lime putty; 5 to 6 sand.*—Suitable for general use above grade and recommended specifically for parapet walls, chimneys and exterior walls; also for structural clay-tile construction.

(2) *1 cement; 2 lime putty; 7 to 9 sand.*—Suitable for non-loadbearing walls either interior or exterior, not subjected to severe exposures; also loadbearing walls in which unit compressive stresses are not excessive.

(3) *1 cement; 0.25 lime; 3 sand.*—Suitable for reinforced-brick masonry and plain masonry below grade or in contact with earth, such as foundations, retaining walls, walks, sewers, manholes, and catch-basins.

The discussion on which these recommendations are based was summarized by Mr. Plummer as follows:

(1) A "good" mortar is one that will adhere to masonry units and when used properly with satisfactory units will produce weather-resistant, durable masonry of the required strength and desired appearance.

(2) For exposed masonry impermeability (water-tightness) is of primary importance.

(3) The use of masonry units and mortar which resist laboratory freezing-and-thawing tests will not insure durable masonry unless the masonry resists water penetration over a long period of time. Materials rating "poor" in laboratory freezing-and-thawing tests may be durable in dry masonry.

(4) Compressive strength of masonry is related to brick strength, mortar strength, and method of laying. The compressive strength of most brick masonry is in excess of the requirements.

(5) Principal factors controlling the transverse strength of brick masonry are mortar strength, bond strength, and workmanship.

(6) Mortar may mar the appearance of brick masonry by:

(a) Bleeding—loss of water during construction which stains the masonry units.

(b) Providing a source of soluble salts which appear as efflorescence.

(c) Erosion under the action of weather.

(7) All masonry mortars should be workable and have the maximum flow consistent with workability.

(8) A high degree of water retentivity is desirable in mortars. Water retentivity is related to workability. High retentivity and high workability are found in the same mortars.

(9) Mortar, particularly for use with dense masonry units in exterior walls above grade, should be reasonably porous (8- to 12-per cent. absorption, 24-hr. cold immersion) in order to allow the escape of moisture from the wall through the mortar joint, and to retard the deposit of soluble salts originally in the mortar on the face of the masonry unit.

(10) Volume changes, due to alternate wetting and drying and shrinkage during and after setting, which exist in all mortars, are of minor importance for mortars of the approximate proportions of 1 part cementitious material to 3 parts aggregate by volume.

"It is rare, indeed, when the working stress on brick masonry exceeds 100 p.s.i.," said Mr. Plummer, "and for this reason I have found little concern among most engineers and architects as to strength of masonry. Their primary interest is in obtaining water-tight construction, the appearance of which will not be marred by constant efflorescence. . . .

"In order to obtain data which might be used as a guide in writing a specification for the testing of brick masonry construction, A.S.T.M. Committee C-15 appointed a working committee in 1937 on the tests for brick prisms. Professor Krefield of Columbia University, who is a member of this committee, agreed to conduct a series of tests to determine the effect of the shape of the specimen on the apparent compressive strength of the masonry. Brick piers 8 in. by 16 in., of 12- to 16-inch cross-section, ranging in height from 8¾ to 97 in., and with height-to-thickness ratios of from 1 to 12, were tested under concentric load to failure. It was found that there was a common relationship between the ultimate strength of the piers and the height-thickness ratios. Compressive strengths ranged from approximately 3,500 p.s.i. for a height-thickness ratio of 1 to approximately 1,500 p.s.i. for a height-thickness ratio of 6. For height-thickness ratios greater than 6, the compressive strength appeared to be constant.

"In this series of tests only one type of brick, one method of bonding, one type of workmanship, and one mortar were used, and before final conclusions can be drawn it will be necessary to investigate the effect of these variables on the strength to height-thickness relationship. However, from the data available, it appears that a correction factor should be applied to the apparent compressive strength of any test specimen of brick masonry having a height-thickness ratio of less than 6 in order to obtain the true strength of the masonry.

"This correction factor as worked out by Professor Krefield, is 0.45 for a height-thickness ratio of 1; 0.80 for a height-thickness ratio of 3; and 0.98 for a height-thickness ratio of 5. These correction factors apply only to brick masonry. They would not apply to a single brick, for instance. Whether or not they are applicable to a 2-brick assemblage is problematical. However, if they do apply to a 2-brick assemblage, the correction factor 0.45 should be used and if the strength of the assemblage does not follow the normal curve for brick masonry, the correction factor probably should be less, say 0.4."

A very important factor in connection with construction, particularly much of the housing that is being built today, said the speaker, is cost. Relatively high lime mortars, in addition to their superior qualities of water retentivity and workability, have the further advantage that they may be obtained at less cost than the high-cement mortars. Based on current prices in Washington, D. C., for cement, quicklime, and sand, the following are the costs per cubic yard of three typical mortar mixes of cement, lime, and sand:

1-0.15-3	$7.34
1-1-6	5.43
1-2-9	4.90

Savings in cost effected by using a 1-1-6 mortar instead of a 1-0.15-3 mortar are 1.3c. per sq.ft. of wall, or $1.05 per 1,000 bricks; and the savings if a 1-2-9 mortar is used instead of a 1-0.15-3 are 1.8c. per sq.ft., or $1.45 per 1,000 bricks.

Discussion by C. C. Connor

C. C. Connor, assistant engineer of the New Jersey Bell Telephone Co., continuing the discussion of Mr. Staley's results, said that, in his opinion, differences in volume change in mortars are not highly important. If the bond is poor, a small amount of volume change will destroy the bond as effectively as one of greater magnitude, and we now know how to avoid the destructive effects. He mentioned L. A. Palmer as having stated that there is no evidence that volume changes in mortar subsequent to hardening destroy the bond when the extent of the bond is good. Professor Voss, he said, had pointed out the importance of the bond layer, and the field evidence indicates that when mortars having high "trowelability" and the ability to form a good bond layer are used with bricks that absorb some water, but so slowly that the mortar remains soft long enough for the bond layer material to accumulate at the bond plane, then the bond formed is seldom destroyed by any amount of volume change. High-lime mortars have proved very effective when used with proper bricks, but they can produce some amazingly bad results if the bricks have a rate of absorption that is too high or too low, he stated. The good results are not due so much to low volume change as to positive beneficial properties. In a good combination of brick and mortar the extent of bond would be high and the destructive effects of volume change would largely disappear.

"The data given [by Mr. Staley] are primarily important because they indicate a reasonable avenue of approach to the problem of developing a proper standard specification for compressive strength of masonry mortars," said Mr. Connor. "However, the suggested requirement that the strength of a 'two-bat' assemblage at 28 days divided by 8 should be not less than the designed load, must be regarded with much caution. It gave consistently good results only with the weak bricks. With the sand-lime brick and the stronger clay bricks, this formula, in many cases, indicated safe loadings for the brick-and-mortar combinations considerably in excess of that indicated by the tests on the piers. The data given in this paper are quite variable, and there are none on the weaker combinations of brick and mortar; but there seems to be a good possibility that the suggested formula would indicate safe loadings up to 250 p.s.i. Beyond that point pier tests might have to be used. There is need of more data like those given by Mr. Staley before there can be any definite judgment on this suggested formula. One thing, however, seems certain; that is, that better judgments can be made of the safe loadings for brick-and-mortar combinations by testing the bricks and mortar in combination than by testing them separately. The strength of a mortar cylinder, tested outside its true environment, gives us very misleading information about the strength of the masonry it will produce. It would seem axiomatic that the only reasonable test of a mortar for masonry would be as a part of masonry.

"I can not support Mr. Staley's suggested supplementary requirement that the ratio of the strength of a 'two-bat' assemblage at 28 days to the strength of the mortar cylinder at 28 days be not

less than 1.25. It would only serve to indicate further that brick-and-mortar combinations were safe for wall loadings that pier tests might show were too high. Also, it is not equally fair to all mortars. As a general rule, I do not favor ratio requirements where direct requirements are possible. This ratio would rule out the cement mortar tested with [certain] bricks, according to the data given, in spite of the fact that the compressive strengths of the piers and 'two-bat' assemblages for those combinations were higher at 6 months than those of any of the others studied. The suggested ratio would require that with these particular bricks a high percentage of lime be used in the mortar in order to lower the strength of the mortar cylinders. If compressive strength is the criterion, this ratio is unreasonable in those cases. All my research and experience with old buildings and new construction definitely indicate the value of high-lime mortars; but that should never lead one into the gross error of accepting an arbitrary requirement which is unfair to another type of mortar. I have spent much time in the last few months writing protests against tests, specifications, primers, *et cetera,* that I feel are unjust to lime mortars; and for the same reasons I protest against this suggested ratio requirement as unfair to other mortars having reasonably satisfactory records.

"There are many wide and puzzling variations in the data," the speaker continued. "The various tests at 28 days on mortar cylinders show that three mortars varied in strength at least 100 per cent. There were many examples among the piers, 'two-bat' assemblages, and mortar cylinders where the tests showed a decrease in strength with age, and several where the rate of increase was extraordinary. There were several cases, also, where the masonry specimens proved stronger with the weaker mortars. Many of the discrepancies smoothed out as the specimens aged, but not all. The reasons for the variations in the data are not apparent and some are so unexpected as to raise the possibility that the cause was some factor or factors not yet fully recognized. One fact, however, remains true, and it is important. In spite of the wide variations, the compressive strength of the weakest pier tested indicated a safe load of 250 p.s.i. This is equal to the highest wall load normally required, and well above most. . . .

"The data show that the dolomitic-lime mortars are consistently stronger than the high-calcium lime mortars. This is as it should be. The high-calcium lime mortars have less volume change after hardening, and the dolomitic-lime mortars are superior in compressive strength. There is an argument, therefore, for each kind of lime.

"I have said that I believe that the differences in volume change are not highly important. I feel also that the differences in compressive strength between mortar mixes will be important only occasionally, because all the mortars tested were satisfactory for higher loadings than ordinarily required for building walls. The importance of this property of compressive strength has long been over-exaggerated. We always design steel and generally design reinforced concrete in the most economical manner possible, using just enough of the materials to obtain the strength required with a reasonable factor of safety. There is no good reason why we should design brick masonry for strength in any different fashion. The property of compressive strength, however, rarely controls the selection of masonry mortar. The requirements for water-tight walls, speed of construction, ease of placing the mortar, and low cost generally are equally important factors. The major problem in masonry is the construction of water-tight walls and the solution lies in properties of mortar other than strength. I hope, and believe, that the data presented in this paper will result in the relegation of the compressive strength of mortar to its true position in importance, and clear the way for the proper consideration of water-retaining capacity, 'trowel-ability,' and the ability to form an adequate bond layer. The latter properties are controlling in the design of water-tight masonry. They are required in varying degrees, depending largely upon the rate of absorption of the masonry units."

Frank W. Lovejoy, sales executive of the Socony-Vacuum Oil Co., introduced a new note when he spoke on *The Man on the Street and His Importance to the Lime Industry.* He emphasized the fact that the average man has no knowledge or understanding of the technical problems discussed and must, therefore, be reached by other means using non-technical approaches.

Effects of Lime in Mortar and Concrete

The Effects of Lime in Mortar and Concrete were discussed at length by Walter C. Voss, professor of building construction at the Massachusetts Institute of Technology. Professor Voss has devoted years to the study of lime as a mortar ingredient and his report presented the results of his latest investigations.

Professor Voss first described the construction and operation of a machine especially designed to make tests on the effects of lime in mortar.

The operation of the machine is a simple application of pressure extrusion. The mortar to be tested is placed in the cylinder, filling it completely to the top, while the piston is at the bottom of its travel. The extrusion head is then placed upon the cylinder and the piston started on its upward travel at a rate of 6 in. per min. The pressure developed by the compacting action is recorded on a time-pressure dial. The maximum pressure attainable in the cylinder is 300 p.s.i. or a total load of about 1 ton on the 3-in. piston. A workable mix will extrude completely without excessive packing during the entire travel, covering 2 min. If the mix is unworkable, the pressure will rise very rapidly and increase rapidly from its uniform travel value to 300 p.s.i. in a few seconds. When this happens the machine is stopped and the packed material removed.

"The length of travel, rate of travel, speed of reduction of section—all have an effect on the relative values only," said the speaker. "We have tried variations of each of these and find only slight changes in the final result, although the time-pressure relation changed considerably. In addition we have used like mortar mixes with low and high flows due to different water content and have found that the compacting is delayed, but occurs finally with only a slight change in the aggregate ratio. In order to eliminate this variable we now mix our mortar and bring it to a flow of 60 at the end of 20 min. of mixing, and then place it in the cylinder. The appearance of the extruding stream also indicates the tendency toward packing and undoubtedly is a factor in the problem. We have only begun to test and check the machine and we expect to have a great deal more to say in the future on its reliability. We believe it will successfully measure:

(a) aggregate carrying capacity of matrix,
(b) effect of gradation of aggregate on (a),
(c) effects of admixtures on (a),
(d) water-retaining capacity of matrix, and
(e) thyxotropic characteristics of matrix."

It seems, according to Professor Voss, that the device gives promise of differentiating between matrix-forming materials. It will be useful in classifying them and will give an excellent index on sands for various uses. At present Professor Voss offers the following general statement on the basis of the materials used:

1. The Portland cements tested will not safely carry more than 2 parts of a graded siliceous sand with a fineness modulus of 2.00.

2. The masonry cement will not carry more than 2½ parts of the same sand.

3. The high-calcium hydrate will not carry more than 2¼ parts of the same sand.

4. The dolomitic hydrate will not carry more than 2¾ parts of the same sand.

5. The high-calcium putty (waterproofed) will carry 3¾ parts of the same sand.

"The use of lime in concrete seems to be a recurring technical problem," the speaker said. "For years many engineers have felt that small quantities of lime had salutary effects upon concrete. In the Proc. A.S.T.M. vol. 8, p. 50, S. E. Thompson stated that additions of 8 to 12 and 16 per cent. of hydrated lime by weight of the cement gave water-tight concrete for 1-2-4, 1-2½-4, and 1-3-5 concretes respectively. J. L. Davies in *Engineering News,* vol. 68, p. 866, stated that the rate of flow through concrete was decreased by replacing 20 per cent. of the weight of the cement by weight with high-calcium lime. The literature of concrete is replete with tests on the use of lime in concrete and now the problem again commands our serious attention. In 1917, Messrs. Scofield and Stinchfield * published conclusions which proved rather conclusively that additions of lime to concrete were effective only in lean mixes but detrimental to strength in richer mixes. These conclusions were undoubtedly true then for the tests made, but we now again have ample laboratory and commercial data to prove that this condition no longer exists. . . . Since the earlier tests along this line the characteristics of Portland cement have changed. We now have more finely ground cement burned at higher temperatures. This has brought about high early strengths and in all fairness it may be said that, as far as strength is concerned, we need have very little fear that almost any cement will produce sufficient resistance to stress. We have, however, become very much more concerned with other important characteristics of concrete. In my mind the most important of these are density and the bond between the mortar matrix and the aggregate. These are allied characteristics, as one supplements the other. Anything which impairs the durability of concrete of necessity impairs its strength. We would even be justified in reducing the early strength of concrete if we were assured of greater durability in the process. Too much emphasis has been laid upon strength and there are those who would prefer materials which when added to ordinary concrete increase its strength, even though they might not permanently act to increase its durability. To consider concrete from all desirable angles would be a much more defensible position.

"It was with this thesis in mind that we made the pilot tests, the results of which are given in this paper. Although they involved the making and breaking of 888 cylinders, it must be remembered that many other combinations must yet be studied before one can reasonably say that one has solved all the characteristics imposed upon concrete by admixtures. It was therefore necessary to limit the variables, retaining only such relations as would measure strength and workability.

"The variables chosen were:

(a) type of cement,
(b) amount of cement,
(c) type of lime hydrate,
(d) amount of lime hydrate,
(e) slump,
(f) curing conditions, and
(g) age.

"All the tests were on 6-in. by 12-in. cylinders using siliceous sand and gravel, each with approximately constant fineness moduli. Two Portland cements were used, one a normal, high-specific-surface cement and the other a normal, medium-specific-surface cement. The amount of cementitious material, including the weight of lime replacing the cement, was varied, using 400, 425, 450, 500 and 550 lb. per cu.yd. of concrete. Two lime hydrates, one a dolomitic masons' hydrate and the other a high-calcium masons' hydrate, were used. The replacement of cement was in the amounts of 25, 50 and 75 lb. of hydrate in place of an equal weight of cement. All the mixes were controlled as closely as possible to produce two slumps, namely 2 in. to 3 in. and 5 in. to 6 in. The curing conditions were varied in three ways. Some of the cylinders were cured in a standard moist room for 28 days and then stored in laboratory air until tested. Other cylinders were stored in laboratory air immediately after making and until tested. The third group were cured 27 days in the standard moist room and then put through 4-week cycles of 3 weeks in laboratory air and 1 week in the moist room, until tested. The moist room was kept at a temperature of 70 deg. ± 1 deg. F. and a relative humidity of about 98 per cent. ± 2 per cent., while the laboratory air was approximately 65 deg. ± 2 deg. F. and had a relative humidity of 30 per cent. ± 5 per cent. Specimens have been tested at 7 days, 28 days and 3 months, and the 1-year specimens are still to be tested.

"The procedure of mixing and casting was arranged to remove as much of the human equation as possible and at the same time to obtain a reasonable check on it. For this reason each batch was made in a Lancaster mixer, using sufficient material to make approximately 1 cu.ft. of concrete. The materials were mixed dry for about 1 min., when the water was added and the entire mass mixed another minute. The slump was then taken and, if within reason, the slump cone material was returned to the pan of the mixer and the mass mixed for about 20 sec. If too dry, additional water was added and the operation repeated. If too wet, the batch was discarded. When the slump was correct, and after reincorporation of the slump-cone concrete, the flow was measured. This concrete was returned to the pan and the mass was mixed again for 20 sec. After this 4 cylinders were cast in paraffined-paper mounds in the usual manner. The entire procedure occupied from 15 to 20 min. per batch. This was repeated 3 or 6 times, as the case might be, so that the three cylinders for each set came from 3 different batches. Cylinders were stored in their moulds in the laboratory until the following day, when they were stripped and placed either in the moist room or on laboratory racks."

One of the speaker's charts showed that for the 2-in. to 3-in. slump replacements of cement with 25 lb. and 50 lb. of dolomitic lime caused an increase in the strength of all the cylinders for all the values of the total weight of cementitious material. Replacements of cement with 25 lb. of high-calcium lime increase the strength, and replacements of cement with 50 lb. of high-calcium lime did not reduce the strength. The use of 75 lb. of high-calcium lime reduces the strength slightly. This is more obvious for the low values of total weight of cementitious materials. It is interesting to note

Total Weight Cementitious Material (*lb.*)	Lime Replacing Cement (*lb.*)	Net Weight of Cement (*lb.*)	Lime (*lb.*) × 100% Net Cement (*lb.*)	Lime (*lb.*)×100% Cementitious Material (*lb.*)
400	25	375	6.7	6.3
	50	350	14.3	12.5
	75	325	23.1	18.8
425	25	400	6.3	5.9
	50	375	13.3	11.8
	75	350	21.4	17.7
450	25	425	5.9	5.6
	50	400	12.5	11.1
	65	375	20.0	16.7
500	25	475	5.3	5.0
	50	450	11.1	10.0

* Proc. A.C.I., vol. xiii, 1217, p. 219.

the relations regarding the percentage of replaced cement for each weight of total cementitious materials [shown in the table on the preceding page].

The optimum effect of lime in increasing the strength of the cement occurs when the lime reaches 8 to 10 per cent. of the weight of the cement for either lime. The dolomitic limes may be added to the extent of 20 per cent. without decrease in strengths, while high-calcium lime may be added to the extent of about 14 per cent. without reducing the strength. A gradual increase in strength may be expected as the cement-aggregate ratio decreases in each type of matrix. Additions of lime allow increases in the aggregate without decrease in strength. For the higher cement-aggregate ratios the use of lime up to 75 lb. is more effective. Stiffer concretes with low cement-aggregate ratios are not as strong as the wetter mixes. In general, the water-cement ratio controls strength. Wetter mixes tend to reduce strength in accordance with the water-cement ratio.

As the cement-aggregate ratio increases for the straight-cement concretes, the water-cement ratio and the flow decrease for the same slump. When 25 lb. of the cement was replaced with lime the general tendency in each case was to reduce the water-cement ratio without materially reducing the flow. Where 50 lb. of the cement was replaced with lime the water-cement ratio either was reduced with no material reduction in flow or remained the same with a slightly reduced flow. The general tendency with 75 lb. of lime was to keep the water-cement ratio and flow the same as the concrete without lime. This would indicate that for normal concrete mixes lime will produce workability and decrease the water-cement ratio. Some of the water undoubtedly had to be used to wet the lime and in a small degree was bound. The determination of the amount of water required to wet the lime completely was not made, but if this were subtracted from the total water used, the true water-cement ratio at early ages would have been even lower. Undoubtedly lime does not create early strengths and it is probably due to its behavior with the water of the mix that the strength-reducing tendency of lime is offset by this decreased water-cement ratio value. It was not until the lime exceeded 20 per cent. of the weight of the cement that the lime reduced the strength factor faster than it did the water-cement ratio.

Early curing is just as necessary for concretes containing lime as for straight-cement concretes. This is probably due to the water-retaining capacity of the lime and its tendency to rob the gel of its water, if not supplemented by moisture from without. This effect is also indicated at 3 months even with intermittent curing, particularly in the wetter mixes.

When lime is not added it would seem that the medium-specific-surface cement has a slightly higher strength, but this is practically of no consequence. However, when lime is added it seems that the high-specific-surface cement is materially aided, while the other cement does not react as favorably. Much has been said of dispersion and there is a possibility that the lime assists in this direction. The finer particles of lime may slightly coat and waterproof the grains in the latter case and thereby retard hydration. In the former case the lime particles, in coating the cement particles, may carry enough water to the cement to assist in hydration. These phenomena of particle size, dispersion and coating are quite important and deserve more attention than some of the chemical considerations now so popular among engineers.

"Although a great many more corroborative tests should be made," said the speaker, "to insure positive conclusions it is clear from these tests that:

"1. 400 lb. of total cementitious material per cu.yd. of concrete is too low safely to produce 3,000-lb. concrete, but is satisfactory for 2,500-lb. concrete.

"2. More than 450 lb. of cementitious materials per cu.yd. of concrete is too conservative, unless strengths over 3,500 p.s.i. are desired.

"3. Replacements of cement in concrete mixes containing from 400 to 450 lb. of cementitious materials per cu.yd., by lime equal to 10 per cent. of the weight of cement, will increase the strength of the concrete, while replacements equal to 15 per cent. will not reduce the strength of the concrete.

"4. That the normal Portland cements on the market are affected similarly by lime.

"5. That strength at the early ages (7 days, 28 days, 3 months) are a function of the water-cement ratio, using the net amount of cement in the mix, regardless of the amount of lime used.

"6. Curing is just as essential for concretes containing lime as it is for straight Portland-cement concretes.

"7. That the use of lime allows the use of more aggregate without reduction in strength.

"8. That lime does retain water from the mix and prevents bleeding inasmuch as slumps were the same, flows were less where lime was used than in the straight-cement concrete.

"9. That lime produced a more cohesive mix of concrete than cement alone.

"10. That the slump test is an unreliable measure of workability, and that the flow is more reliable.

"11. These tests justify the following relations between 7-day, 28-day and 3-mos. tests regardless of the use of lime up to 50 lb. per cu.yd.,

$$f_{28} = f_7 + 25\sqrt{f_7}$$

$$f_{90} = f_7 + 35\sqrt{f_7}$$

"12. That inasmuch as the early strengths of cement are definitely related to the water-cement ratio as stated in (5) and inasmuch as the replacement of cement with lime up to 50 lb. per cu.yd. of concrete, gave higher strengths than straight cement concrete, the use of lime reduced the water-cement ratio for the same slump."

Discussion by A. T. Goldbeck

The discussion of Professor Voss' paper was led by A. T. Goldbeck, engineering director, National Crushed Stone Assn.

"We became interested in stone sand as a fine aggregate in concrete several years ago and decided to see what factors were involved in the question of workability of concrete," he said. "We wanted specifically to improve the workability of stone-sand concrete. So, along with changes in gradation, we investigated the effects of additions of different percentages of stone dust and also different percentages of lime. . . .

"Here are some of the essential data which a concrete technician would need for a comparison with the data of Professor Voss:

"*Coarse Aggregate*—Limestone (Lab. No. 35) (Purchased in Washington, D. C.)

Sieves (in.)	*Total Passing*	
2	100	Wt. per cu.ft.
1½	97	equals 91.6 lb.
1	62	(loose)
¾	42	
½	25	
No. 4	2	

"*Fine Aggregate*—Limestone sand (same limestone as coarse aggregate) graded as follows:

Sieves (in.)	*Total Passing*	
No. 4	100	Wt. per cu.ft.
8	90	equals 95.0 lb.
16	50	
30	30	
50	10	
100	3	

"A part of the fine aggregate was replaced with an equal weight of hydrated lime in the amounts of 0, 2½, 5, and 7½ per cent. by weight of fine aggregate. Pour mixes were made as [shown in the table on the next page].

"No attempt will be made to discuss the above results in detail compared with Professor Voss'. At the outset all his results with lime are obtained with a lower cement factor than used in our tests. His results would apply to the ordinary grade of structural concrete

containing about 5 bags of cement per cu.yd. and extending down through the leaner mixes. The closest approach to

Identification	1	2	3	4
Per cent. hydrated lime by weight of fine aggregate	0	2.5	5.0	7.5
Per cent. hydrated lime by weight of cement	0	5.9	11.8	17.7
Ratio fine aggregate to coarse aggregate	41	41	41	41
Slump (in.)	3	3	3	3½
Flow (per cent.)	169	165	170	165
Bags cement per Cu. Yd. of concrete	5.85	5.90	5.82	5.82
W/C	0.81	0.78	0.84	0.89
Water gain (cu. ft. of water per cu. ft. concrete	0.015	0.007	0.005	0.002
Compressive strength, 28 days	5140	5590	5580	4880
Modulus of rupture, 28 days	853	895	864	842
Proportions (by loose volume) 1:2.37:3.50				

a comparison with our own tests may be obtained with the mixes containing 500 lb. of cementitious material cured for 28 days in water. Twenty-five lb. of lime and 475 lb. of cement are equivalent to 5.25 per cent. lime, and 50 lb. of lime with 450 lb. of cement is 11.1 per cent. lime. These mixes are about like our lime mixes containing 5.9 and 11.8 per cent. lime, respectively, by weight of cement. We obtained about a 10-per cent. gain in compressive strength for the 5.9-per cent. lime mixture at 28 days; Professor Voss gets an increase from 4,070 to 4,890, or 820 lb., or roughly 20 per cent. We get an increase of 8.5 per cent. for 11.8-per cent. lime; Professor Voss gets an increase of a little over 20 per cent. . . .

"We all are looking for the practical significance of tests such as these and, it is important to ask ourselves, 'What do they mean from the standpoint of the value of lime in concrete?' The very fact that a relatively-low cement factor is sometimes used, means that high strength for such mixtures is considered of minor importance. Then, too, the item of cost of the mixes is a practical matter. Suppose we do wish to increase the strength. Shall we add more cement or shall we, in lean mixtures, add lime or even replace some cement with lime? Well, this becomes a matter of relative cost to accomplish the desired gain in strength. My personal opinion is that the gain in strength to be obtained with replacements of lime or additions of lime is not sufficient to make this an outstanding, although much-to-be-desired, attribute of lime in concrete. Surely there must be something else to look for as the result of lime additions to concrete.

"In my table of test results I show a column headed 'Water Gain,' and it is indicated that water gain is decreased with additions of lime. Water gain, or bleeding of water from concrete, is considered a bad feature in concrete. In concrete roads this phenomenon leads to the possibility of a high water-cement ratio at the top of the slab where there should be a low water-cement ratio. Would not a series of tests on the proportion of lime in preventing bleeding of concrete and water gain be promising? The concrete roads in Delaware have been built for years with lime admixtures and they show very little scale. May not this be significant?

"Certainly lime promotes the quality of workability in concrete. Mixes having lime may have lower slump and lower flow than non-lime mixes and yet be far more workable with a lesser or no greater water-cement ratio than straight-cement mixtures.

"What about the use of lime admixtures in structures subjected to water action? Portland cement gives off calcium hydrate rather continuously. I wonder if lime additions would not serve to prolong the life of concrete structures where water action is a factor by preventing lime depletion.

"It seems that durability of concrete by all odds is the important property to be sought. Whether lime will help durability, I do not know. Certainly, it helps workability and indirectly durability by cutting down on the water cement ration in some cases."

Discussion by Stanton Walker

Stanton Walker, director, engineering and research division, National Sand & Gravel Assn., commented on Professor Voss' paper by giving his conception of the function of admixtures. He reviewed the history of the subject briefly, saying:

"In 1888 a paper in the Transactions of the American Society of Civil Engineers states that lime added to cement reduces strength. In 1906 Lazell, writing in the Proceedings of the American Society for Testing Materials, concluded that additions of lime to cement decreased permeability. In 1908 Sanford E. Thompson made permeability tests of concrete with additions of hydrated lime which showed, if my memory serves me, favorable results. In 1911 R. J. Wig concluded that hydrated lime in mortars up to 15 per cent. of the weight of the cement did not affect the tensile strength of leaner mixtures but reduced that of rich ones; for compressive strength he found increases for both lean and rich mixes. He also found permeability to be decreased and plasticity increased. In 1915 an article in *Engineering News-Record* refers to hydrated lime in road concrete and states that the use of 10 to 11 per cent. of lime resulted in denser concrete and fewer cracks. In 1917 Scofield and Stinchfield reported lowered strength, abrasion and density, and increased expansion and contraction because of the use of lime. In 1920 Abrams concluded that hydrated lime as an admixture reduced the compressive strength of all concrete mixtures that he investigated—and his investigations covered a wide range. Again, in 1929, Abrams concluded that workability was not improved and that strength was reduced by various powdered admixtures, including lime. 'All the commercial admixtures,' he said, 'must be classed as injurious adulterants, due to their high water factors.'

"In my opinion, an outstanding reason for such conflicting opinions has been the inability of the investigator to determine what constitutes comparable mixes, and that inability has come, for the most part, from lack of facilities for obtaining a real measure of that intangible property which, for want of a better word, we call workability. Most so-called measures, as Professor Voss points out, determine only a part of the story. They give some idea of consistency but little of real workability. And, of course, one of the difficulties in developing methods for the measurement of that illusive property comes from our lack of any clear-cut definition of it; it is one thing under one set of conditions of use and another thing under another set. Changes in cement have contributed to differences in results of tests with admixtures, but I think that, as I have just said, the technique of the conduct of the tests has been the more important factor.

"Certainly the slump does not measure workability, although it does afford a basis for maintaining uniformity in consistency of mixtures of the same or similar proportions. Obviously, a 1-2-4 mix of a 3- to 4-in. slump bears no relationship, so far as workability is concerned, to a 1-1½-3 mix of the same slump. The flow test is a step in advance, but it is open to most of the same objections that may be stated for the slump test—widely-different mixtures of the same flow do not have the same degree of workability. Much the same comment can be made with respect to any of the many measures which have been advanced—or at least those with which I am familiar—although it should be said that successive attempts to develop a measure for workability have represented improvement—steps in the direction of measuring that property which we wish to have measured. . . .

"Admixtures are generally conceived as falling into two classifications—those which are chemically active and those which are inert. Of course, there are degrees of chemical activity and also, I suspect and to talk loosely, degrees of inertness. A discussion of the chemically-active group is not particularly pertinent at this time. Hydrated lime is grouped, according to the rough clas-

sification just given, as one of the inert admixtures.

"Concrete may be described as a mixture of inert granular material bound together by a cementing substance. The basic inert granular materials are fine and coarse aggregate—sand and gravel, sand and stone, sand and slag, or a fine aggregate resulting from the crushing of any of these materials together with a coarse aggregate. The cementing substance is the product resulting from the combination of water and Portland cement. Concrete must have sufficient strength, sufficient resistance to abrasion, sufficient ability to resist the penetration of water, and sufficient resistance to weathering. It must be so proportioned that it will flow or can be worked into the space which it is designed to fill. All these properties are to some degree interrelated. I could spend a great deal of time developing those interrelationships but I shall refrain from doing so. For the purpose of illustration, however, we can see that, in a broad general way:

"1. Strength depends on the strength of the cementing medium and that is a function of the ratio of water to cement;

"2. Resistance to penetrating water depends on density;

"3. Resistance to weathering depends on density and on the integrity of the various ingredients; and

"4. Workability depends on the proper distribution of the various sizes of the granular particles, including those in the cement.

"Of course, all the preceding categorical statements require qualification and limitation, but they will serve for illustration.

"Now, what can be the function of a powdered admixture in such a combination?—and I include lime putty as a powdered admixture. I have said that strength depends on the strength of the cementing medium. Of course, that must be qualified by saying that the mixture must be so proportioned that the cementing medium can function properly. Therefore, it seems to me, we should not look to admixtures of the relatively-inert type to improve strength, except in so far as they may correct deficiencies in the size arrangement of the granular material, and that probably can be done more economically in other ways. This same statement applies, I think, to the next two properties I have named—permeability and durability—always assuming that the concrete is put into place in a proper manner. What I have said would seem to be self-evident, if the admixture in question is really inert; and, in the case of lime, I do not believe that we can consider it as a wholly-inert material. To the extent that it is active my statement needs to be qualified.

"The fourth property I listed suggests what seems to me to be the real field of powdered admixtures—that of improving the workability of the concrete—making it easier to put into place. Concrete of the greatest density and of the greatest strength for a given consistency is relatively harsh-working. A great many years ago William B. Fuller and Sanford E. Thompson evolved the classic Fuller's curve of maximum density. Any one who has designed concrete in accordance with that curve knows that it produces concrete of maximum density, or approximately so, and of maximum strength, but that it is a harsh-working concrete. It seems to me that the addition of a lubricant of the nature of hydrated lime offers real promise for improving the placeability of such mixtures and of permitting the engineer to design concrete approaching maximum density and strength, and at the same time be able to place it. Further, however we modify the properties of conventional materials there is, in many cases, a 'harshness' to concrete which can be eliminated by the addition of a finely-divided powder approaching the amorphous, as is the case with lime.

"Unquestionably the nature of the cement as well as that of the aggregate influences the effect which an admixture will have. The more-finely-ground cements of to-day are more nearly uniform in size; the top size has been reduced, but there has not been a corresponding reduction in the bottom size. This condition does not contribute to workability. Professor Voss has shown some improvement in strength by the addition of lime and he has emphasized that such improvement that occurred was in proportion to the reduction in the water-cement ratio. He is, in my opinion, on entirely safe grounds when he bases his findings on that claim. He states that there was an improvement in placeability for a given consistency which accompanied the increased strength, and that appears entirely reasonable to me.

"I want to emphasize, and I am sure that Professor Voss will agree with this statement, that one of the factors influencing the results which he obtained was the mixes which were used. They were relatively-lean and relatively-harsh mixes. The richest is of the order of magnitude of 1-2-4 and the leanest is somewhat leaner than 1-2½-5. The ratio of sand to coarse aggregate is only 1 to 2 and that is a low ratio for use with a coarse aggregate having a maximum size of only ¾ in. Undoubtedly, in my mind, partial explanation for the rather large increases in strength which he found comes from the fact that the workability, and hence the placeability, of the concrete was improved by the addition of lime. Other results should be expected from tests of other mixtures. However, strength should not be used as the measure of effectiveness of an admixture such as lime. It is easy to design a concrete having sufficient strength. The importance of strength has undoubtedly been over-emphasized for the principal reason that it is a tangible property of concrete which can be measured quantitatively, and that is not true of most other important properties of concrete. The field for the relatively-inert powdered admixture must be found in the improvement of properties other than strength, and I urge that it your further investigations you give special consideration to workability, permeability, and durability."

Discussion by Sanford Thompson

Miles N. Clair, scheduled to comment on Professor Voss' paper, was not present. Sanford E. Thompson, president of Mr. Clair's company, the Thompson & Lichtner Co., Inc., spoke briefly in his stead, referring to some of his experiences with lime.

Mr. Thompson said in part:

"As Professor Voss says, strength is often of minor importance. Does this raise the question whether in more cases a straight-lime mortar can be used instead of a cement mortar to reduce cost and, if so, what are the limitations?

"Lime is excellent for increasing workability. Not only must a mortar be workable when freshly made, but it must retain this workability for a reasonable time. The retention of water is important and requires further tests.

"We find, for example, that the addition of hydrated lime or putty to ready-mixed concrete tends to stiffen it more rapidly, thus inducing the addition of more water which tends to defeat the purpose of the addition of lime. More tests with the time variable are needed.

"Mr. Parsons stated that the proportion of lime does not materially affect the penetration of water. We found contrary results in an extended series of tests we made last year with brick piers laid up in our laboratory where water was forced against the face to simulate a rain-carrying wind moving at 40 to 50 mi. per hr. There was less penetration in the mortar joints laid with the higher proportions of lime.

"The penetration of water, in some cases at least, increases with the age of the mortar. Tests, under 5-ft. head, for 1:1:6 and 1:2:9 mortars using three types of lime—one of them giving the best results was a waterproofed lime—showed more than double the flow in cubic centimeters when a year old than at one month. The flow continually increased in the test specimens at 3

months, 6 months, and a year. Mr. Parsons, I think, stated that he found no increase, but other factors may have influenced the test.

"The importance of size and gradation of the particles of sand in a mortar is all too little appreciated. Professor Voss mentions this as a field for study. To illustrate, a dry sand with 1/64-in. particles of uniform size has exactly the same void content as a sand with ¼-in. particles of uniform size, but the effect on mortar is vastly different because of the difference in bulking when wet. Furthermore, as shown by tests made over 30 years ago, the cement must be included with the sand in determining gradation, because, before hardening, the grains of cement are equivalent in physical action to grains of sand of the same size, yet this fact has been overlooked by most experimenters, including Professor Abrams. Further study is needed on this point. . . .

"We . . . know . . . that excess lime in concrete produces cracks or crazing apparently due to volume changes. For this reason, we limit lime in concrete to 5 per cent. of the cement. Professor Voss indicates that 10 per cent. is good, and so it is from the standpoint of permeability or strength. In fact, this was proved by our 1908 tests. . . .

"An increase in lime increases watertightness of concrete. Professor Voss has referred to tests we made for the Boston Elevated Railroad and presented before the American Society for Testing Materials in 1908. The conclusions reached at that time may be worth reading (vol. xiii, p. 501).

" '1. Hydrated lime increases the water-tightness of concrete.

" '2. Effective proportions of hydrated lime for water-tight concrete are as follows:

" 'For 1 part Portland cement: 2 parts sand: 4 parts stone, add 8 per cent. hydrated lime.

" 'For 1 part Portland cement: 2½ parts sand: 4½ parts stone, add 12 per cent. hydrated lime.

" 'For 1 part Portland cement: 3 parts sand: 5 parts stone, add 16 per cent. hydrated lime.

" 'These percentages are based on the weight of the dry portland cement.

" '3. The cost of large waterproof concrete structures frequently may be reduced by employing leaner proportions of concrete with hydrated lime admixtures, and small structures, such as tanks, may be made more water-tight.

" '4. Lime paste made from a given weight of hydrated lime occupies about 2¼ times the bulk of paste made from the same weight of Portland cement, and is therefore very efficient in void filling.

" 'Although the character of the sand and stone used in the concrete will affect the best percentage of lime to be used, the present materials are representative of average materials throughout the country, so that the results should be of general application. Coarser sand would naturally require slightly larger percentages of lime, and finer sand, that is, sand having a larger percentage of fine grains which pass a sieve with 40 meshes to the linear inch, would be apt to require less lime, since sand containing considerable fine material produces a more water-tight although a weaker concrete.' "

Proportions C—HL—S	*Brand*	Water (cc.) Entering Specimens in First Hour (5-ft. head) *28 days*	*3 mos.*	*6 mos.*	*1 year*
0:1:3	A	1,732	1,197	461	501
	B	6,673	1,680	442	232
	C	2,354	536	144	141
1:1:6	A	45	38	58	81
	B	15	23	40	58
	C	11	15	31	35
1:2:9	A	82	105	99	134
	B	53	59	63	108
	C	25	37	61	81

All specimens were tested hourly and similar characteristics were found up to 28 hr.

Announce Winners in Safety Contest

Thirty-five lime plants took part in the fourth annual safety competition conducted by the Bureau of Mines in cooperation with the National Lime Assn. This is the largest number of operations enrolled in any one of the four years during which the contest has been conducted. During 1935 and 1936 twenty-eight plants were enrolled and in 1937 thirty plants participated in the contest. This increasing enrollment is evidence of the growing interest on the part of the various producers of lime in safeguarding their employees from injury. Indications are that the contest being conducted during the present year (1939) will be even broader in scope as forty-two plants have already enrolled.

The rules of the 1938 contest provided for the issuance of a certificate of honor to the winning plant in each of two groups, plants employing an average of 50 or more men, and those employing fewer than 50 men.

The plant in the group employing 50 or more men that had the best safety record in 1938 was the Billmeyer, Pa., plant of the J. E. Baker Co. This plant operated 170,442 man-hours during 1938 without a disabling injury.

In the group of plants employing fewer than 50 men the honors went to the Chicago, Ill., plant of the Marblehead Lime Co. This plant operated 79,512 man-hours without a disabling injury.

In addition, certificates of honor were awarded to the following six plants for also having accident-free records during 1938:

McCoy plant, Bridgeport, Pa., operated by the Warner Co. This plant was in operation 73,230 man-hours.

Quincy, Ill., plant operated by the Marblehead Lime Co. This plant was in operation 68,398 man-hours.

Oranda plant, Strasburg, Va., operated by the National Gypsum Co. This plant was in operation 59,970 man-hours.

Rockwood plant, Manitowoc, Wis., operated by the Rockwell Lime Co. This plant was in operation 28,770 man-hours.

Newala, Ala., plant operated by the Newala Lime Works. This plant was in operation 24,960 man-hours.

Thornton, Ill., plant operated by the Marblehead Lime Co. This plant was in operation 22,067 man-hours.

Among the 35 enrolled plants in 1938 there were 119 disabling accidents. Of these, two were fatal accidents and were each charged with 6,000 days of disability, according to the rules of the safety contest. Five accidents were permanent partial injuries such as the loss of use or dismemberment of some part of the body; these were charged with a total of 5,429 days of disability. The remainder, or 112 injuries, were temporary in character and each was charged with the actual number of days during which the injured employee was disabled. The 112 temporary injuries accounted for 3,049 days of disability, an average of 27 days per injury. This compares with an average of 25 days in 1937, 27 in 1936, and 25 in 1935, showing great similarity in length of time lost from temporary injuries but no evidence of any trend toward severe temporary accidents.

Of the 119 injuries, 75 could be classified by causes, but for the remainder there was not sufficient information to do so. In this connection all contestants are urged to send in a complete report of each accident that occurs; failure to do so, under the contest rules, makes the plant ineligible for award. The principal causes of accidents were handling rock or other material, falls of persons, falls and slides of rock or overburden, hand tools, and burns (including lime burns). These are essentially the same causes that accounted for the majority of accidents in 1937.

NATIONAL GYPSUM'S NEW SAVANNAH PLANT

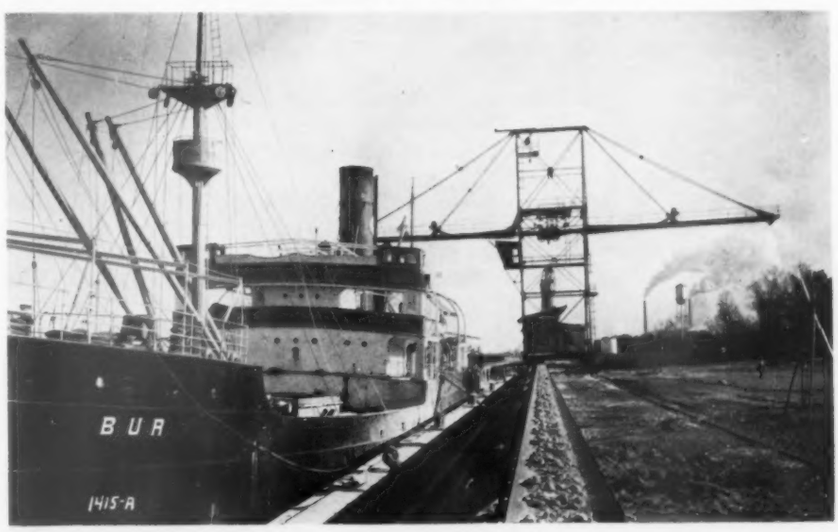
THE business development of the Southeast, which has been a distinctly encouraging note in the industrial picture for a number of years, was given an added impetus early in 1939 by the completion of two complete gypsum-processing and board plants. The largest one, with which this article is concerned, is the new plant of the National Gypsum Co. at Savannah, Ga., which was formally opened on May 22, 1939.

Raw Gypsum rock, brought down by boat from the company's quarries at Cheticamp, Walton or Dingwall in Nova Scotia, is used, making available for the first time in this territory gypsum products without the former prohibitive freight charges. This plant will divide the southeastern territory formerly served by the company's plants at Fort Dodge, Ia., Clarence Center, N. Y., and Rotan, Tex. It is another step in the company's program of decentralization of production and will increase its facilities to serve market areas.

The products of this plant include a complete line of gypsum board, lath and sheeting, grain board, foil board and foil lath. All kinds of prepared and hard-wall plasters, cement plasters, gaging and molding plasters, cement rock and agricultural land plaster are also made. A complete line of metal lath, finishing lime, fiber insulating board, etc., made at others of the company's plants, are carried in stock so that complete mixed carloads can be shipped direct. The plant has a capacity of 250,000 sq. ft. of board and 350 tons of plaster in a 24-hr. day and a car of cement rock can be loaded every hour.

The plant site, which comprises 50 acres acquired from the Savannah & Atlanta Railroad Co., has a water frontage of 700 ft. on the west side of the Savannah River, 5 mi. northwest of

The pivoted-boom stacker which can stock-pile to a height of 55 feet within a 265-degree arc.



Boats are unloaded by this traveling crane which can handle 400 tons of gypsum per hour.

• By W. E. TRAUFFER

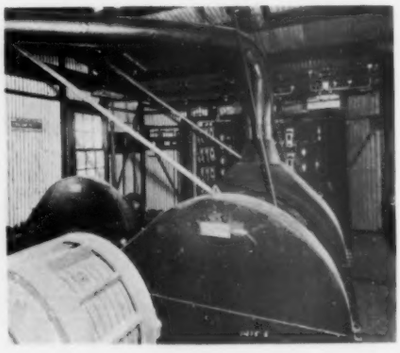
The self-propelled stacker has a boom conveyor 100 feet long and travels almost the entire length of the 392-foot conveyor which feeds it.

The stock-pile built by the stacker has a storage capacity of 60,000 tons of gypsum. The material is reclaimed by a crane.

downtown Savannah and about 22 mi. from the ocean. To make it possible for ocean-going vessels to unload at its dock the company dredged over 85,000 tons of silt from the harbor line to the channel line. There is now 27 ft. of water at low tide, enough to accommodate the largest steamers. The dock is 400 ft. long and is built of sheet-steel piles and concrete. The largest boat unloaded to date carried a net cargo of 6,000 tons of rock and made the trip from Nova Scotia in 8 days.

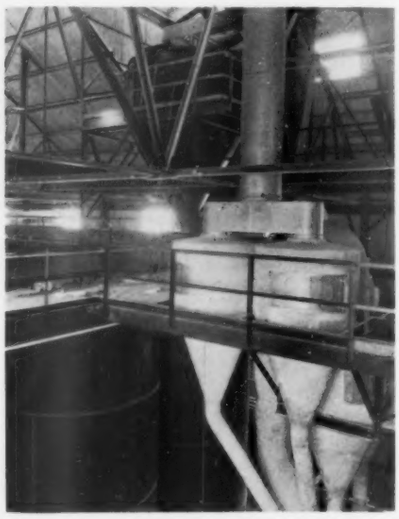
Unloading of the boats is done at the rate of 400 t.p.h. by a Robins Type C traveling electrically-operated unloading tower or crane, which travels the full length of the dock on a 25-ft. gage track. This tower is of the T type with a boom track extending 60 ft. on each side. The boom on the water side can be raised to clear the ship superstructure when the tower is being moved. A 2-cu.yd. Robins Mead-Morrison clamshell bucket, traveling on this boom, picks up the gypsum rock in the hold of the ship and deposits it in a hopper on the crane, from which it is taken by the conveyor system. With this crane it is planned to load bundles of board and lath into ships for water shipment. Two of the four trucks on which this crane is supported are equipped with automatic rail clamps to insure against tipping during a heavy wind. These clamps are connected with an anemometer and automatically grip the rails when the wind velocity reaches 30 m.p.h.

The gypsum is discharged by the bucket into the 50-ton hopper. The conveyor system for handling the rock to storage consists of three 30-in. belt-conveyors, Nos. 1, 2 and 3. An apron-feeder takes it from the hopper to the 352-ft. dock belt-conveyor (No. 1), which carries it to the 208-ft. long belt-conveyor (No. 2), set at right angles to the dock belt. The last-mentioned belt is inclined at its discharge end to feed



Belt-conveyor motors and drives.

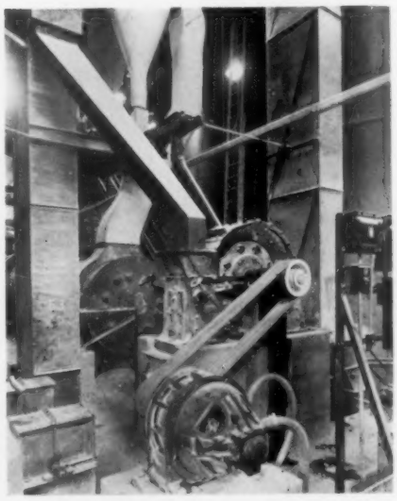
conveyor No. 3, which is depressed at its feed end in order to keep both conveyors at the same elevation. Conveyor No. 3 is driven at its feed end through a snub pulley and has an automatic gravity take-up. It is 392 ft. long and dis-



Cyclones and dust-collectors connected to the coarse-rock mills.

charges into a hopper on the Robins stacker. The gypsum is discharged into stock-piles by means of a 100-ft. belt-conveyor on the stacker boom. The stacker is self-propelled and operates on 20-ft. gage tracks for almost the full length of the belt.

The stacker pivots around the hopper and can be swung in an arc of 265 deg.

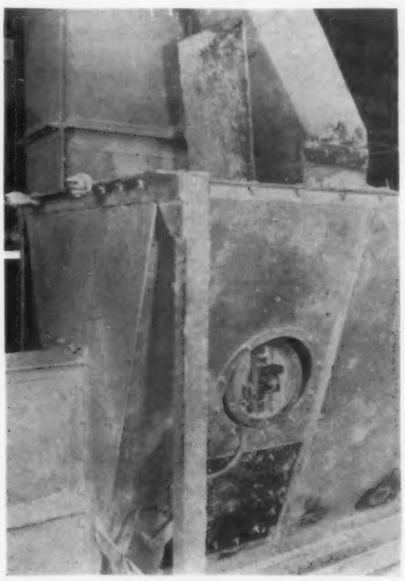


The hammer-mill and its motor with feed elevator at left and elevator to separator at right.

It can be raised and lowered to reduce breakage and segregation in stock-piling and can stock-pile to a height of 55 ft. Gypsum rock is discharged from the stacker into stock-piles on one side of the track. The storage capacity will be about 60,000 tons. A Northwest crane reclaims the gypsum from the stock-piles to a Robins 12-ft. square movable

hopper on the stacker track. A special feeder discharges the rock to conveyor No. 3, which transfers it to the stacker boom belt-conveyor which carries it to either of the two plant bins, one of which ($8a_1$ in the accompanying flow-sheet) is used for feeding the roll-crusher with oversize rock and the other (10) for regular rock.

The feeder hopper has a capacity of 50 tons. A Link-Belt heavy-duty apron-feeder discharges the rock into a Traylor 42-in. by 16-in. roll-crusher ($8a_3$). In the preparation of cement rock the minus 1½-in. crusher product is carried by a chain-bucket elevator to a 4-ft. by 8-ft. Link-Belt 2-deck vibrating screen ($8a_5$), which usually has 1½-in. wire cloth on its top deck and ¼-in. on its bottom deck. The material retained on the bottom deck is cement rock and is discharged on the first of a series of two belt-conveyors.. From the second of these conveyors it falls through a chute with a flexible spout to a car-loader for



The stucco-feed bin with contents-level indicator.

loading into box-cars or direct into gondola cars.

The plus 1-in. rock retained on the top deck of this screen and the minus ¼-in. rock passing through the bottom deck are discharged on a 32-ft. distributing belt-conveyor. A plow roll can be moved to any point on this conveyor to distribute the rock into the 500-ton bin (10). Any material adhering to this belt is automatically brushed off one end and is discharged direct to an elevator feeding the drier which will be described later.

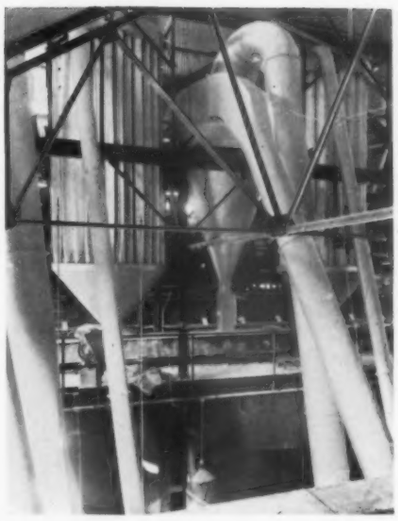
When rock is being processed for use in this plant, the quarry-size stone is discharged from the stacker boom conveyor into the 500-ton bin (10) mentioned above. This stone is minus 3-in. and under. Five reciprocating feeders discharge it from this bin on a belt-conveyor feeding the drier elevator. The use of five feeders makes it possible to obtain full recovery from the bin and to control the rate of rock feed to the mill department, which has a capacity of about 30 t.p.h. A 26-in. diameter Stearns stationary magnet, suspended over the belt-conveyor, removes any tramp iron which may be in the rock.

The stone is discharged from the elevator through a spout into a Hardinge

Steel silos for coarse and fine materials from separator.

Ruggles-Cole 6-ft. by 40-ft. indirect-heat rotary drier (14), which has a capacity of about 30 t.p.h. The drier is fired with oil by a Todd mechanical-atomizing burner. Taylor recorders keep a record of the temperatures of the flue gas and of the rock.

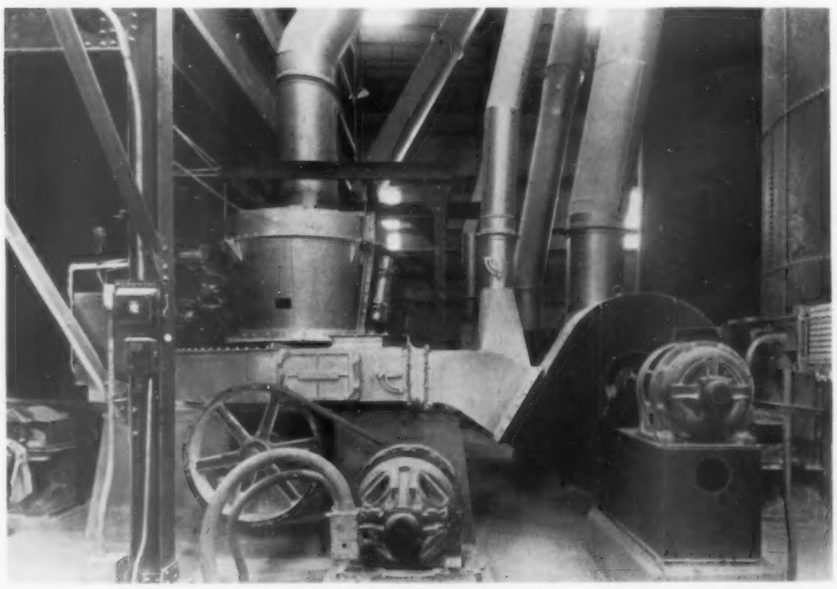
A special type of screw-conveyor carries the dried rock to a chain-bucket elevator, from which it is discharged through a spout into a No. 3 Williams



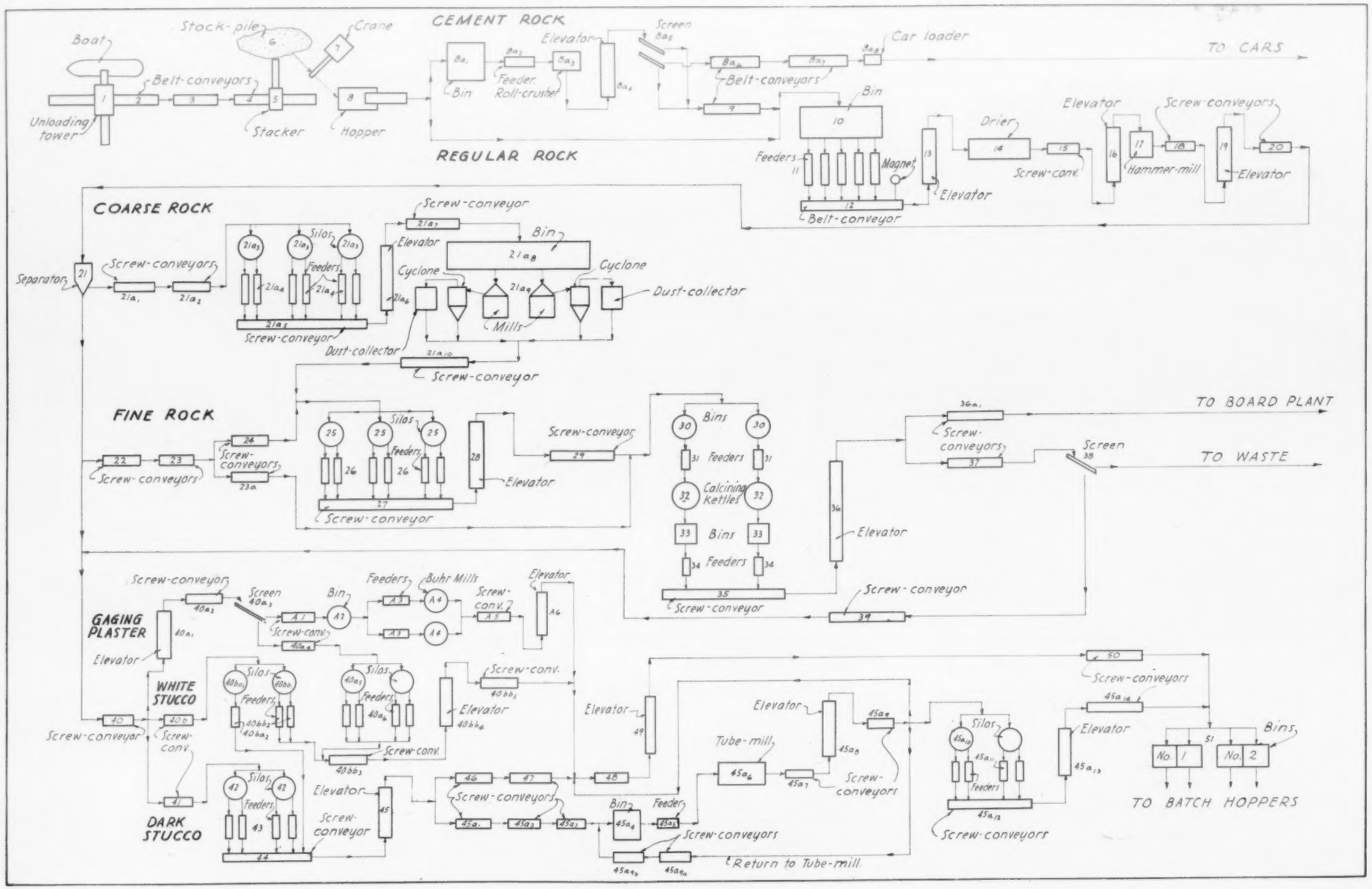
Part of dust-collecting system.

hammer-mill (17). This reduces the rock so that about 40 per cent. will pass through a 100-mesh sieve. A screw-conveyor, a chain-bucket elevator and another screw-conveyor carry the material to a 12-ft. Sturtevant mechanical-air separator (21), which separates the feed into a product, 85 per cent. of which will pass through a 100-mesh sieve, the oversize being used for feed to the Raymond mills.

From the separator a screw-conveyor can discharge this material into an inclined screw-conveyor (23), followed by a horizontal screw-conveyor, from which it is discharged into either of two 100-ton catenary-type bins (30) over the calcining kettles. The inclined screw (23) can also feed a screw-conveyor which discharges the separator fines into three 170-ton storage silos (25).



Two 5-roll mills for coarse rock, showing motors and pipes to cyclones and dust collectors above.



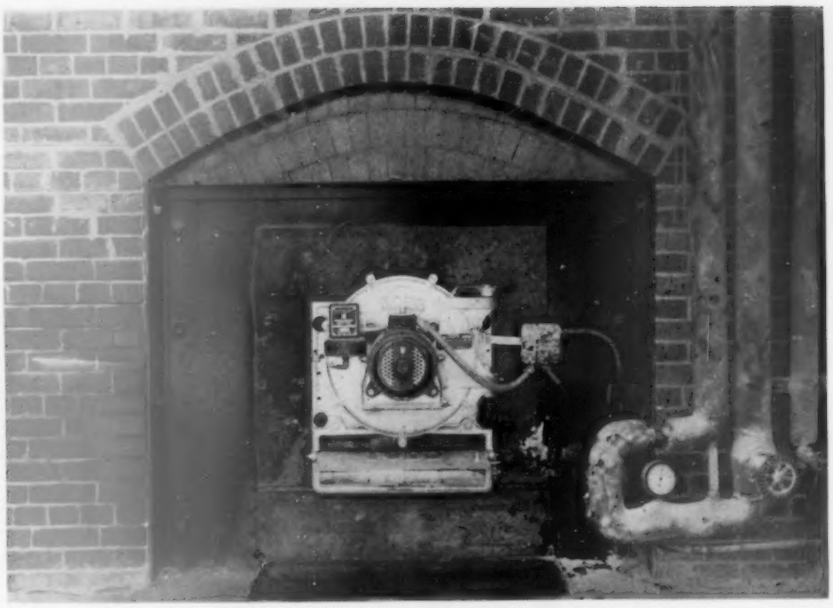
Flow-sheet of the operations of the National Gypsum Company at Savannah, Georgia.

FLOW-SHEET AND TABULAR ANALYSIS OF THE OPERATIONS AND EQUIPMENT OF THE NATIONAL GYPSUM CO., SAVANNAH, GA.—PART I

(Key numbers refer to corresponding numbers on accompanying flow-sheet.)

Operation	Key No.	Equipment	Make	Model No., Size Capacity or Type	Motors	Drive
Gypsum-Rock Unloading and Storing		(From boats at dock)				
	1	Unloading tower	Robins	Gantry type, 60-ft., 25-ft.-gage booms, (4)		
		Bucket	Robins-Mead-Morrison	2-cu. yd. clam-shell		
		(From bucket)				
		Hopper	Robins	50-ton steel		
		Feeder	Robins	Apron, 3-ft. by 7-ft.		
	2	Conveyor (No. 1)	Robins	Belt, 30-in. by 352 ft.	15-hp.	
	3	Conveyor (No. 2)	Robins	Belt, 30-in. by 208 ft.	15-hp.	
	4	Conveyor (No. 3)	Robins	Belt, 30-in. by 392 ft.	30-hp.	
	5	Stacker	Robins	Traveling 20-f . gage, 100-ft. boom		
		Conveyor, Boom	Robins	Belt, 30-in. by 100 ft., 265-deg. swing		
	6	Stock-piles		60,000-ton capacity		
	7	Crane	Northwest	Crawler		
	8	Hopper	Robins	Traveling, 20-ft. gage		
		Feeder	Robins	Apron		
		Conveyor, Boom (To $8a_1$ or 10)	Robins	Belt		
Cement-Rock Processing and Loading		(From 8)				
	$8a_1$	Bin		50-ton capacity		
	$8a_2$	Feeder	Link-Belt	Apron, 30-in. by 6-ft. heavy-duty	5-hp., 875-r.p.m., Westinghouse	4-strand V-belt, herringbone reducer and chain
	$8a_3$	Crusher	Traylor	Roll, 16 in. by 42 in.	75-hp., 870-r.p.m., Westinghouse	6-strand V-belt
	$8a_4$	Elevator	Link-Belt	Chain-bucket	10-hp., 875-r.p.m., Westinghouse	3-strand V-belt
	$8a_5$	Screen	Link-Belt	Vibrating, 2-deck, 4-ft. by 8-ft.	3-hp., 1,750-r.p.m., Westinghouse	2-strand V-belt
		($1\frac{1}{2}$-in. to $\frac{1}{4}$-in. to $8a_6$, fines and oversize to 9) (From $8a_5$)				
	$8a_6$	Conveyor	Link-Belt	Belt, 18-in. by 32-ft.	3-hp., 870-r.p.m., Westinghouse. (Also drives 9)	3-strand V-belt
	$8a_7$	Conveyor	Link-Belt	Belt, 18-in. by 65-ft.	5-hp., 870-r.p.m., Westinghouse	3-strand V-belt
	$8a_8$	Car-loader (To cars)	Stephens-Adamson			
Regular-Rock Storing, Drying, Pulverizing and Separating		(From $8a_5$)				
	9	Conveyor	Link-Belt	Belt, 18-in. by 32-ft.	(See $8a_6$)	6-strand V-belt and chain
		(From 8 or 9)				
	10	Bin		500-ton		
	11	Feeders (5)		Reciprocating		
	12	Conveyor	Link-Belt	Belt, 18-in. by 32-ft.	$7\frac{1}{2}$-hp., 870 r.p.m., Westinghouse	6-strand V-belt and chain
		Magnet	Stearns	Suspended, 26-in. diameter		
	13	Elevator	Link-Belt	Bucket, 37-ft.	5-hp., 870-r.p.m., Westinghouse	4-strand V-belt
	14	Drier	Hardinge Ruggles-Cole	Rotary, 6-ft. by 40-ft. indirect-heat, 30-t.p.h.	25-hp., 720 r.p.m., Westinghouse	Falk herring-bone reducer
		Fan			10-hp., 1,165-r.p.m., Westinghouse	5-strand V-belt
	15	Conveyor	Link-Belt	Screw, 16-in. by 10-ft., heavy-duty	$1\frac{1}{2}$-hp., 56.5-r.p.m.	Chain
	16	Elevator	Link-Belt	Chain-bucket, 27-ft.	5-hp., 870-r.p.m., G. E.	4-strand V-belt
	17	Hammer-mill	Williams	No. 3	75-hp., 1,165-r.p.m., G. E.	6-strand V-belt
	18	Conveyor	Link-Belt	Screw, 16-in. by 14-ft.	$1\frac{1}{2}$-hp., 56.5-r.p.m., G. E.	Chain
	19	Elevator	Link-Belt	Chain-bucket, 63-ft.	15-hp., 870-r.p.m., Westinghouse	3-strand V-belt and chain
	20	Conveyor	Link-Belt	Screw, 12-in. by 12-ft.		
	21	Separator	Sturtevant	12-ft. mechanical	30-hp., 1,170-r.p.m., Westinghouse	7-strand V-belt
		(Coarse to $21a_1$, fines to 22 and 40)				
Coarse-Rock Storing and Grinding		(Coarse from 21 and coarse from land-plaster department)				
	$21a_1$	Conveyor	Link-Belt	Screw, 16-in. by 39-ft.	15-hp., 870-r.p.m., Westinghouse (Also drives 22)	3-strand V-belt, herringbone reducer and chain
	$21a_2$	Conveyor	Link-Belt	Screw, 12-in. by 38-ft.		
	$21a_3$	Silos (3)		170-ton each		
	$21a_4$	Feeders (6)	Link-Belt	Drag-chain, 7-in. by 22-ft.	10-hp., 870-r.p.m., Westinghouse	Herringbone reducer and chain
	$21a_5$	Conveyor	Link-Belt	Screw, 12-in. by 41-ft.		
	$21a_6$	Elevator	Link-Belt	Bucket, 40-ft., centrifugal-discharge	10-hp., 870-r.p.m., G. E.	3-strand V-belt and chain
	$21a_7$	Conveyor	Link-Belt	Screw, 12-in. by 42-ft.		
	$21a_8$	Feed bin		170-ton		
	$21a_9$	Mills (2)	Raymond	5-roll, low-side, 10-t.p.h.	75-hp., 1,165-r.p.m., G. E. (2)	6-strand V-belt
		Cyclones (2)	Raymond	8-ft. diameter		
		Dust-collectors (2)	Raymond	15-ft. tubular		
		Fans (2)			50-hp., 1,760-r.p.m., G. E. (2)	4-strand V-belt
	$21a_{10}$	Conveyor	Link-Belt	Screw 12-in. by 43-ft.	10-hp. 880-r.p.m. Westinghouse (Also drives 24)	6-strand V-belt, herringbone reducer and chain
		(To 25)				
Fine-Rock Handling and Storage		(From 21)				
	22	Conveyor	Link-Belt	Screw, 12-in. by 50-ft.	(See $21a_1$ and $21a_2$)	
	23	Conveyor	Link-Belt	Screw, 12-in. inclined	10-hp., 870-r.p.m., Westinghouse (Also drives $23a_1$)	6-strand V-belt, herringbone reducer and chain
		(To 24 or $23a_1$)				
		(From 23)				
	$23a_1$	Conveyor (To 30)	Link-Belt	Screw, 12-in. by 36-ft.	(See 23)	(See 23)
	24	Conveyor (To 25) (From 24 and $21a_{10}$)	Link-Belt	Screw, 12-in. by 37-ft.	(See $21a_{10}$)	(See $21a_{10}$)
	25	Silos (3)		170-ton each		
	26	Feeders (6)	Link-Belt	Drag-chain, 7-in. by 22-ft.	10-hp. 870-r.p.m. Westinghouse	Herringbone reducer and chain
	27	Conveyor	Link-Belt	Screw, 12-in. by 37-ft.		

(Continued on page 39)



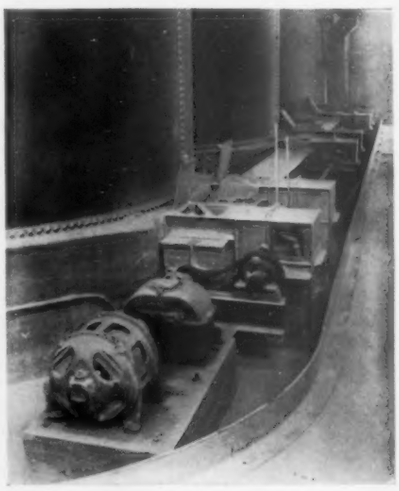
Oil burner on one of the gypsum-calcining kettles.

These store fine land plaster ahead of the calcining kettles.

The coarse material rejected by the separator goes to a series of two screw-conveyors, from the second of which it is discharged into three 170-ton Raymond mill storage silos ($21a_3$). Two drag-chain conveyors under each silo withdraw material from it to a screw-conveyor. From this a bucket-elevator feeds another screw-conveyor which discharges the material into a 170-ton Raymond mill-feed bin ($21a_8$). This bin supplies two Raymond 5-roll low-side mills ($21a_9$), each of which grinds 10 t.p.h. to a fineness of 85 per cent. through 100-mesh. Each mill has its own automatic motor-driven feeder and is equipped with the latest type of separator. These separators are mounted on separate steel frames which keep any vibration in the mills from affecting the efficiency of the separators. These separators are followed by two 8-ft. diameter Raymond cyclones which operate in series with two Raymond 15-ft. tubular dust-collectors. The cyclones and collectors discharge into a screw-conveyor which distributes this material into the three kettle storage silos (25) previously mentioned.

Material is reclaimed from these silos by six drag chains, two to each silo, followed by a screw-conveyor, a bucket-elevator and another screw-conveyor from which the material is discharged into the two kettle-feed bins (30) already described. A drag-chain in the bottom of each bin feeds one of the two kettles.

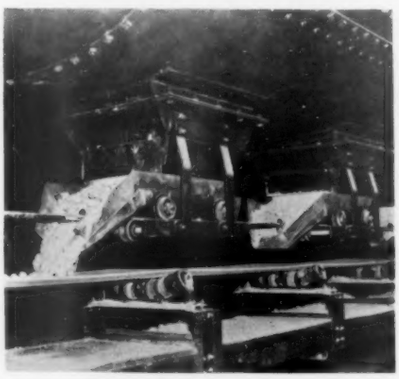
The two calcining kettles, showing oil burners at bottom right and driving mechanism above.



Motor, speed-reducer and chain driving drag-chain feeders and screw-conveyor taking coarse rock from silos.

The two Ehrsam gypsum-calcining kettles (32) are of the latest improved type and have a capacity of 7 t.p.h. each. They have an inside diameter of 10 ft. They are oil-fired by Todd Model D burners, and a calcining temperature of from 300 to 350 deg. F. is maintained. Each of the kettles is vented to a Raymond dust-collecting system.

The calcined gypsum is discharged from the kettles through a gate into the two steel hot-pit bins, each of which will hold three batches. Drag chains under these bins discharge to a screw-conveyor followed by a continuous bucket-elevator. The entire conveying system from the kettles has a capacity of 60 t.p.h. The bucket-elevator can discharge the kettle product either to a conveyor ($36a_1$) to the board plant or to a 12-in. by 136-ft. screw-conveyor (37) for the warehouse department. The latter conveyor feeds a single-deck Tyler 3-ft. by 5-ft. Hum-mer screen (38) with 30-mesh cloth, which is used for scalping any oversize or foreign material. The small amount of material retained on this screen is wasted and the fine product goes to a screw-conveyor followed by a 12-in. by 136-ft. distributing screw-conveyor (40) to the plaster mill.



Reciprocating feeders discharging gypsum from 500-ton bin above on belt-conveyor to the drier.

In the plaster mill the calcined gypsum can be discharged from the last-mentioned screw-conveyor (40) to either of two flows—one for the manufacture of dark stucco, and the other for white stucco. The dark stucco material is discharged by a screw-conveyor (41) into two 160-ton silos (42). Two drag chains under each silo feed this material to a screw-conveyor followed by a bucket-elevator (45). From this point the material can be sent either to the tube-mill ($45\ a_6$) or direct via a conveyor to the mixer bins (51).

The white-stucco material follows a more complicated flow. It is discharged from the above-mentioned screw-conveyor (40) to another screw-conveyor (40b) from which it can be sent by either of two routes to the mixer bins. In one of these flows ($40\ ba_1$, etc.) this material is discharged from this conveyor (40b) into a 160-ton silo ($40ba_1$)

FLOW-SHEET AND TABULAR ANALYSIS OF THE OPERATIONS AND EQUIPMENT OF THE NATIONAL GYPSUM CO., SAVANNAH, GA.—PART II

(Key numbers refer to corresponding numbers on accompanying flow-sheet.)

Operation	Key No.	Equipment	Make	Model No., Size Capacity or Type	Motors	Drive
	28	Elevator	Link-Belt	Bucket, 50-ft. centrifugal-discharge	10-hp. 870-r.p.m. Westinghouse	3-strand V-belt and chain
	29	Conveyor (To 30)	Link-Belt	Screw, 12-in. by 25-ft.		
Calcining		(From 23a$_1$ and 29)				
	30	Bins (2		80-ton, catenary type		
	31	Feeders (2)	Link-Belt	Drag-chain, 21-ft.	3-hp. 103-r.p.m. G. E. (2)	Chain
	32	Kettles (2)	Ehrsam	Calcining, 10-ft. diam., 7-t.p.h.	30-hp. 865-r.p.m. G. E. (2)	
	33	Bins (2)		Hot-pit, steel, 5-batch		
	34	Feeders (2)	Link-Belt	Drag-chain, 18½-ft., 60-t.p.h.	5-hp., 860-r.p.m., Westinghouse (2)	Planetary reducer and chain
	35	Conveyor	Link-Belt	Screw, 16-in. by 21-ft.	7½-hp., 865-r.p.m., Westinghouse	4-strand V-belt, herringbone reducer and chain
	36	Elevator (To 36a$_1$ and 37)	Link-Belt	Bucket, 61-ft., centrifugal-discharge		
Delivery to Board Plant	36a$_1$	Conveyor (To board plant)	Link-Belt	Screw, 12-in. by 136-ft.	15-hp., 870-r.p.m., Westinghouse	3-strand V-belt, herringbone reducer and chain
Screening and Warehouse Feed		(From 36)				
	37	Conveyor		Screw, 12-in. by 7-ft.	10-hp., 865-r.p.m., Westinghouse (Also drives 39)	7-strand V-belt and chain
	38	Screen (Tailings to waste, fines to 39)	Tyler	Hum-mer vibrating, 3-ft. by 5-ft., 1-deck		
	39	Conveyor (Calcined gypsum from 39 or air-separated gypsum from 21)	Link-Belt	Screw, 12-in. by 7-ft.	(See 37)	(See 37)
	40	Conveyor (Dark stucco to 41; separator fines to 40a$_1$; white stucco to 40b)	Link-Belt	Screw, 18-in. by 136-ft.	15-hp., 870-r.p.m., (Also drives 41 and 40b)	3-strand V-belt, herringbone reducer and chain
Gaging-Plaster Sizing		(From 40)				
	40a$_1$	Elevator	Link-Belt	Bucket, 21-ft., centrifugal-discharge	5-hp., 860-r.p.m.	4-strand V-belt and chain
	40a$_2$	Conveyor	Link-Belt	Screw, 12-in. by 19-ft.		
	40a$_3$	Screen (Fines to 40a$_4$, coarse to A1)	Tyler	Hum-mer vibrating, 4-ft. by 10-ft., 1-deck		
Coarse Gaging-Plaster Grinding		(From 40a$_3$)				
	A1	Conveyor	Link-Belt	Screw, 9-in. by 15-ft.		
	A2	Bin		40-ton, cylindrical		
	A3	Feeder	Link-Belt	Screw, 6-in. by 14-ft.	3-hp., 860-r.p.m.	Herringbone reducer and chain
	A4	Buhr mills (2)	Munson	36-in., under-runner type	40-hp., 450-r.p.m., Allis-Chalmers (2)	Direct-connected
	A5	Conveyor	Link-Belt	Screw, 9-in. by 13-ft.	1½-hp., 71-r.p.m., G. E.	Chain
	A6	Elevator (To 48)	Link-Belt	Bucket, 47-ft., centrifugal-discharge	3-hp., 860-r.p.m., G. E.	3-strand V-belt
Fine Gaging-Plaster Storing	40a$_3$	(From 40a$_2$) Conveyor	Link-Belt	Screw, 12-in. by 22-ft.	7½-hp., 865-r.p.m.	5-strand V-belt, herringbone reducer and chain
	40a$_4$	Silos (2)		120-ton each		
	40a$_6$	Feeders (4) (To 40bb$_3$)	Link-Belt	Drag-chain, 22-ft.		
White-Stucco Storing and Handling	40b	(From 40) Conveyor (To 40ba$_1$ and 40bb$_1$)	Link-Belt	Screw, 12-in. by 14-ft.	(See 40)	(See 40)
	40ba$_1$	Silo		160-ton		
	40ba$_2$	Drag chains (2)	Link-Belt	22-ft.		
		(From 41a$_1$)				
	40bb$_1$	Silo		120-ton		
	40bb$_2$	Drag chains (2) (From 40bb$_2$ and 40a$_6$)	Link-Belt		10-hp., 865-r.p.m., G. E.	Herringbone reducer and chain
	40bb$_2$	Conveyor	Link-Belt	Screw, 12-in. by 40-ft.		
	40bb$_4$	Elevator	Link-Belt	Bucket, 46-ft., centrifugal-discharge	7½-hp., 865-r.p.m., Westinghouse	6-strand V-belt and chain
	40bb$_5$	Conveyor (To 48)	Link-Belt	Screw, 12-in. by 20-ft.		
Dark-Stucco Storing and Handling		(From 40)				
	41	Conveyor	Link-Belt	Screw, 12-in. by 32-ft.	(See 40)	(See 40)
	42	Silos (2)		160-ton each		
	43	Feeders (4) (To 44)	Link-Belt	Drag-chain, 22-ft.	10-hp., 865-r.p.m. (Also drives 44)	Herringbone reducer and chain
White- and Dark-Stucco Handling		(From 40ba$_2$ and 43)				
	44	Conveyor	Link-Belt	Screw, 12-in. by 40-ft.	(See 43)	(See 43)
	45	Elevator (To 45a$_1$ or 46)	Link-Belt	Bucket, 48-ft.	7½-hp., 865-r.p.m. (Also drives 45a$_1$, 46 and 47)	6-strand V-belt and chain

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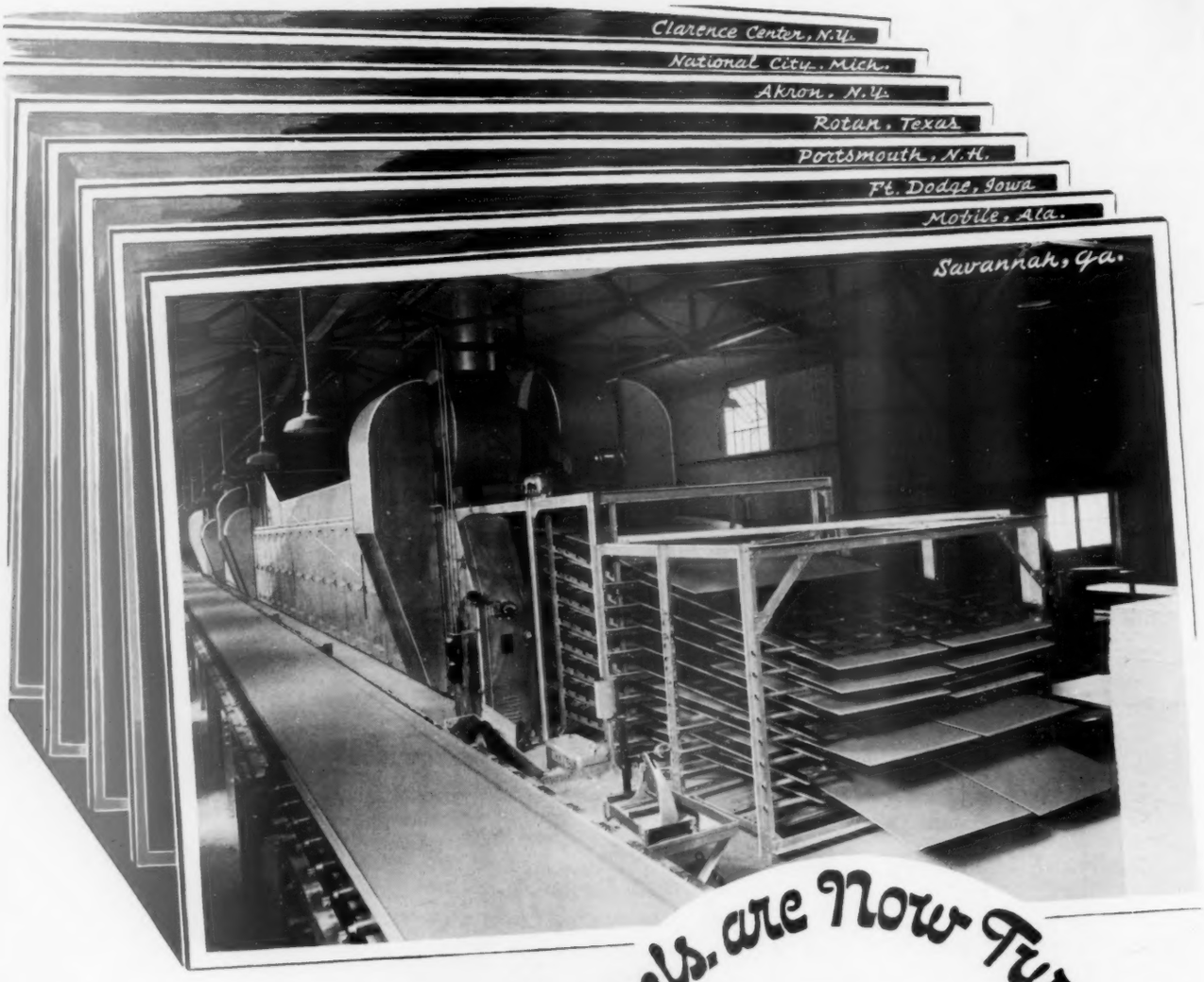

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FLOW-SHEET AND TABULAR ANALYSIS OF THE OPERATIONS AND EQUIPMENT OF THE NATIONAL GYPSUM CO., SAVANNAH, GA.—PART III

(Key numbers refer to corresponding numbers on accompanying flow-sheet.)

Operation	Key No.	Equipment	Make	Model No., Size Capacity or Type	Motors	Drive
White- and Dark-Stucco Grinding		(From 45)				
	$45a_1$	Conveyor	Link-Belt	Screw, 12-in. by 20-ft.	(See 45)	(See 45)
	$45a_2$	Conveyor	Link-Belt	Screw, 12-in. by 26-ft.	7½-hp., 865-r.p.m.	5-strand V-belt, herringbone reducer and chain
	$45a_3$	Conveyor	Link-Belt	Screw, 12-in. by 25-ft.		
		(From $45a_3$ and $45a_{9b}$)				
	$45a_4$	Bin		50-ton, steel		
	$45a_5$	Feeder	Link-Belt	Drag-chain, 16-ft.	3-hp., 860-r.p.m., G. E.	Link-belt herringbone reducer and Allis-Chalmers speed changer
	$45a_6$	Tube-mill	Allis-Chalmers	5-ft. by 22-ft.	150-hp., 500-r.p.m., G. E.	Falk herringbone reducer
	$45a_7$	Conveyor	Link-Belt	Screw, 12-in. by 12-ft.	3-hp., 71-r.p.m., G. E.	Chain
	$45a_8$	Elevator	Link-Belt	Bucket, 48-ft., centrifugal-discharge	10-hp., 865-r.p.m., G. E.	3-strand V-belt and chain
	$45a_9$	Conveyor (To $45a_{9a}$, $45a_{10}$ and 48)		Screw, 12-in. by 14-ft.		
		(From $45a_9$)				
	$45a_{9a}$	Conveyor	Link-Belt	Screw, 9-in.	5-hp., 860-r.p.m.	4-strand V-belt, herringbone reducer and chain
	$45a_{9b}$	Conveyor	Link-Belt	Screw, 9-in.		
	$45a_{10}$	Silos (2)		200-ton each		
	$45a_{11}$	Feeders (4)	Link-Belt	Drag-chain, 24-ft.	10-hp., 865-r.p.m., G. E.	Herringbone reducer and chain
	$45a_{12}$	Conveyor	Link-Belt	Screw, 12-in. by 41-ft.		
	$45a_{13}$	Elevator	Link-Belt	Bucket, 54-ft., centrifugal-discharge	15-hp. 870-r.p.m., G. E.	3-strand V-belt and chain
	$45a_{14}$	Conveyor	Link-Belt	Screw, 12-in. by 57-ft.		
White- and Dark-Stucco Handling		(From 45)				
	46	Conveyor	Link-Belt	Screw, 12-in. by 13-ft.	(See 44)	(See 44)
	47	Conveyor (To 48)	Link-Belt	Screw, 12-in. by 9-ft.		
White- and Dark-Stucco and Gaging-Plaster Handling		(From $40bb_3$, 47, A6 and $45a_3$)				
	48	Conveyor	Link-Belt	Screw, 16-in. by 88-ft.	10-hp. 865-r.p.m., G. E.	3-strand V-belt, herringbone reducer and chain
	49	Elevator	Link-Belt	Bucket, 17-ft. centrifugal-discharge	10-hp., 865-r.p.m., G. E.	6-strand V-belt and chain
	50	Conveyor (From 50 and $45a_{14}$)	Link-Belt	Screw, 12-in. by 50-ft.		
	51	Mixer bins (2) (To mixers. See text.)		80-ton, catenary type, 2-compartment		

from which a pair of drag chains feed it to the screw-conveyor and elevator (45) described above. From this elevator this material also can be sent either to the tube-mill ($45a_6$) or via another route (46, etc.) to the mixer bins (51), which will be described.

The tube-mill flow for both dark and white stuccos is the same. Following the bucket-elevator (45), a series of three screw-conveyors ($45a_1$, etc.) discharge into a 50-ton steel tube-mill feed bin ($45a_4$). From this bin a drag chain, driven through an Allis-Chalmers No. 310 Vari-Pitch unit-speed changer and a Link-Belt herringbone-gear reducer, feeds the material into the tube-mill. Varying the rate of feed controls the plasticity of the tube-mill product. A screw-type feeder (not shown separately on the flow-sheet) discharges this material into the 5-ft. by 22-ft. Allis-Chalmers tube-mill ($45a_6$), which is loaded with 16 tons of 1¼-in.-diameter manganese-steel balls. The tube-milling process gives increased bulk and improved working qualities to the calcined gypsum.

The product, either white or dark, of the tube-mill is carried by a screw-conveyor followed by an elevator to another screw-conveyor ($45a_9$). From this conveyor a series of two screw-conveyors can return first-run tube-mill product to the mill-feed bin ($45a_4$) when starting up cold. Otherwise the tube-mill product can follow either of two flows to the stucco-mixer feed bins. For direct feed to these bins the mill product can be discharged from the above conveyor ($45a_9$) to a screw-conveyor (48), from which a bucket-elevator and another screw-conveyor carry it to the mixer-feed bins (51). The kettle stucco, untubed dark and light, from the elevator (45) can be discharged to a series of two screw-conveyors (46 and 47), from which this material also follows the primary flow through screw-conveyor (48) to the mixer bins (51).

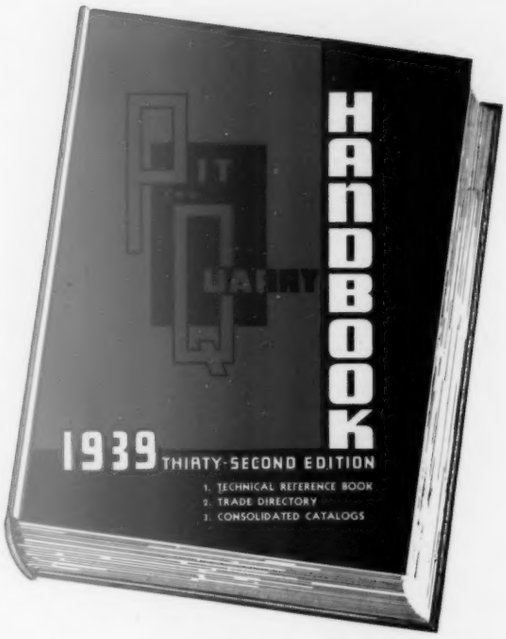
Ordinarily the tube-mill product from the conveyor ($45a_9$) is discharged into two 200-ton silos ($45a_{10}$). Two pairs of drag chains, one under each silo, are followed by a screw-conveyor and elevator and conveyor discharging into the mixer bins (51).

In making gaging plaster the calcined product from the screw-conveyor (40) is discharged to an elevator and thence to a screw-conveyor feeding a 4-ft. by 10-ft. 1-deck Tyler Hum-mer screen ($40a_3$) with 36-mesh cloth. The material passing through this screen is gaging plaster, running 85 per cent. through 100-mesh and 100 per cent. through 40-mesh. This material is carried by a screw-conveyor to two 120-ton silos ($40a_3$), from each of which a pair of drag chains feeds it to the conveyor ($40bb_3$) in the main flow to the mixer feed bins (51).

The coarse product retained on the above gaging-plaster screen ($40a_3$) is carried by a screw-conveyor to a 40-ton cylindrical bin (A2), for preparation as white molding plaster.

Screw-feeders discharge this material into two 36-in. Munson under-runner-type Buhr mills (A4). The mill product is carried by a screw-conveyor to an elevator (A6), from which it is discharged to the conveyor (48) in the flow to the mixer bins (51).

The two catenary-type mixer bins (51) have capacities of 80 tons each and each one has two compartments. They are designated as bins No. 1 and 2. Under the No. 1 bin is a 2,000-lb. weigh hopper of the company's own design which is mounted on a Fairbanks tank-type scale. Solenoids and mercoid switches are used to shut the feed off automatically at the desired weight. A right- and left-hand screw under the



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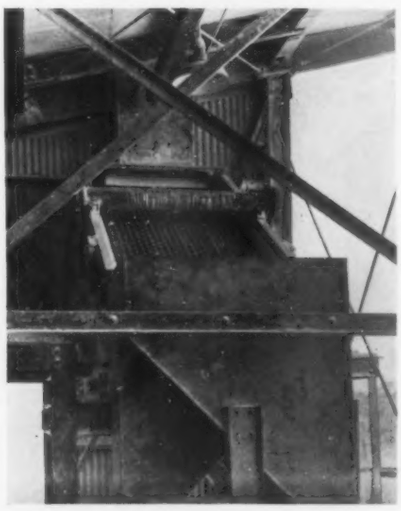
bins feeds any desired material to this batcher. With this system the desired amount of accelerator or retarder is added automatically and the batcher will not dump until all the admixtures in proper proportions for a batch have been added. No admixtures are used for gaging plaster. A Broughton 1-ton dry-type mixer with blades of the company's own design is under the No. 1 batcher. The mixing cycle is also automatically controlled. The finished plaster is discharged into a hopper over a 4-tube Bates packer and is put in 100-pd. Multi-wall paper bags.

The arrangement under the No. 2 bin is similar, except that two weigh hoppers are used to feed two 1-ton Broughton mixers. The method of control is also automatic and the mixers dump alternately into a common hopper feeding another 4-bag packer. Under each packer is a hopper to send spilled plaster back to the mixer or to waste.

Agricultural land plaster is also made in this plant in a separate department, which has not been included in the accompanying flow-sheet or tabular analysis. The material for this department is pulverized and dried raw gypsum obtained from the screw-conveyor (20) which also feeds the separator.

The fines from the separator, set for special fineness, are carried by a 12-in. screw-conveyor to three 160-ton silos. A pair of drag chains under each silo feeds a 12-in. screw-conveyor followed by a bucket-elevator and a 12-in. screw-conveyor. The material coming from this conveyor is discharged into a 180-ton packing bin.

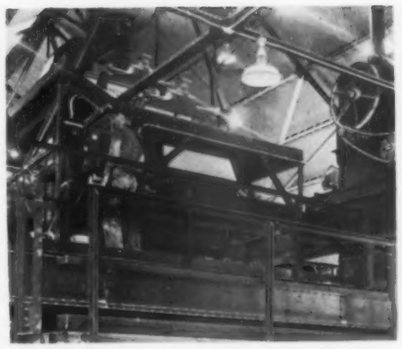
A 12-in. screw-conveyor can feed from this bin to an open-mouth packer, a 4-tube cement-type Bates packer, or to trucks. Bagged land plaster is shipped in cars and trucks. The screw-conveyor can also discharge to a 12-in.



Vibrating screen which sizes product of roll-crusher.

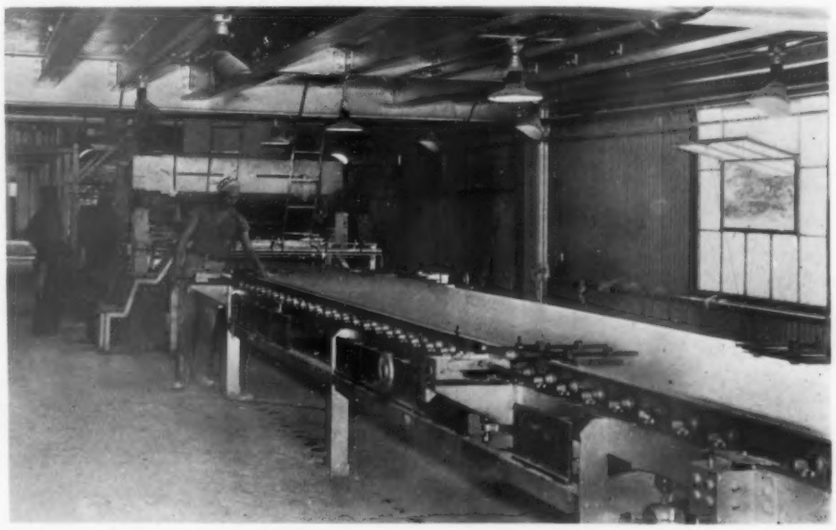
screw-conveyor which returns this material either to the above-mentioned elevator for bulk car-loading or into the system ahead of the Raymond mills. This recirculation system makes it possible to utilize the agricultural-plaster storage facilities when the land-plaster season is over.

The calcined gypsum for the board mill is brought over from the calcining department by the 12-in. screw-conveyor ($36a_1$) previously mentioned, which is supported on a steel conveyor gallery, and is discharged into two 170-ton bins, from which it is reclaimed as needed by two drag-chain conveyors. These feed it to an elevator which in turn discharges it to a 9-in. screw-conveyor feeding a 3,000-lb. capacity stucco-feed bin. This bin is equipped with high- and low-level Bindicators, which automatically control the drag-conveyors, elevator and screw-conveyor to keep the bin's contents at a constant head.



Vibrating screen which sizes material for plaster and stucco departments.

A special type of elevator, driven through a Link-Belt P.I.V. variable-speed control, feeds the hydrated pulp into a weir-type distributing box, from which it is discharged evenly at a constant rate of flow to the soak belt at a point just beyond the fluted-roll assembly. The soak belt is 48 in. wide and 120 ft. long. At about the middle point of this belt a foam solution from a special type of generator is added. A 42-in. unit finger-type agitator mixes the ingredients on the soak belt before they are discharged into a vertical-spindle mixer or blender. This blender is driven by a 15-hp. motor through V-belts and a Horsburg & Scott vertical worm-gear reducer.



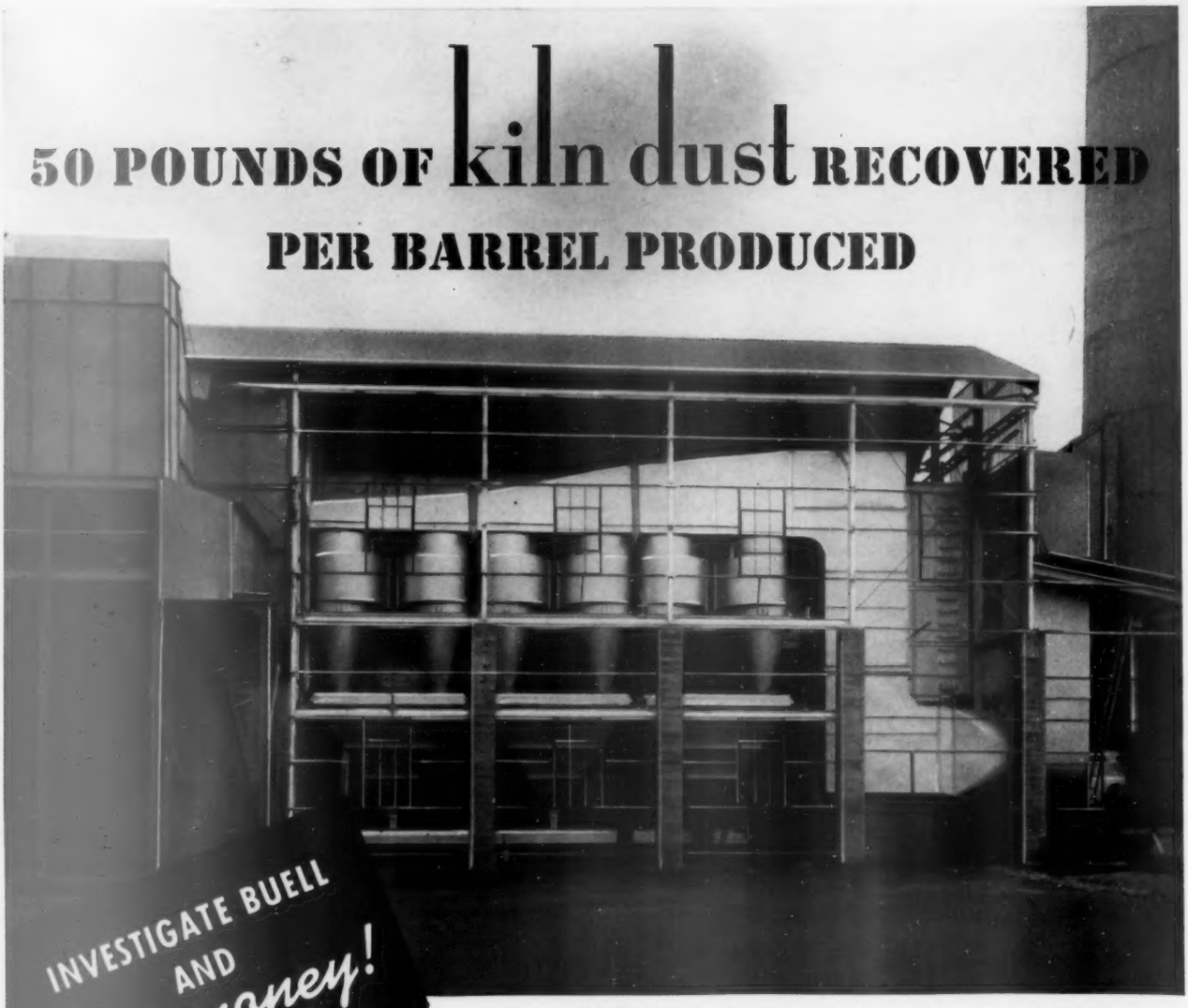
The discharge end of the plaster-board machine.

A drag-chain conveyor feeds gypsum from this bin to the soak belt-conveyor at a point just ahead of the fluted-roll assembly. The drag is driven through a Link-Belt P.I.V. variable-speed control so that the rate of stucco feed can be varied. The soak belt is driven by a 7½-hp. motor through chain, an inclosed-type Lewellen variable-speed control and a Link-Belt herringbone-gear reducer.

The paper pulp which is one of the chief ingredients is made from old newsprint. This is pulped with water in a Downington beater, which has a batch capacity of 3,600 gal. The product, containing 3 per cent. paper pulp, is discharged by gravity into a 6,000-gal. concrete pulp chest, which is below the floor level and is equipped with off-center agitating paddles driven through a Link-Belt worm-gear reducer and V-belts.

The mixture is then discharged in the desired amount on one layer of paper lying on the lower-deck plate of the board machine. The paper is scored for folding and passes through edge formers just ahead of the forming or squeeze rolls, which are set for the desired thickness. Here the back paper is brought into contact and the edges are sealed. The paper, which is manufactured under National Gypsum specifications and supervision, is supplied to

50 POUNDS OF kiln dust RECOVERED PER BARREL PRODUCED



24 Buell (Van Tongeren System) Cyclones at the Kosmosdale, Kentucky, plant of Kosmos Portland Cement Company

Fifty pounds of kiln dust recovered every day for each barrel of cement produced! But that is only *part* of the story of economy and efficiency at this progressive plant.

The Kosmos Portland Cement Company is not only securing a high over-all collection efficiency. It is doing this at the lowest possible cost. It is writing off its investment in the shortest possible time.

The complete Buell Dust Collection plant will pay for itself in little more than three years. Thereafter the recovery will be practically a 100% net profit operation, for maintenance costs are so low as to be negligible.

Investigate Buell and you will find that the low initial cost and high over-all collection efficiency guarantee the maximum return on your investment.

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SALES OFFICES IN PRINCIPAL CITIES

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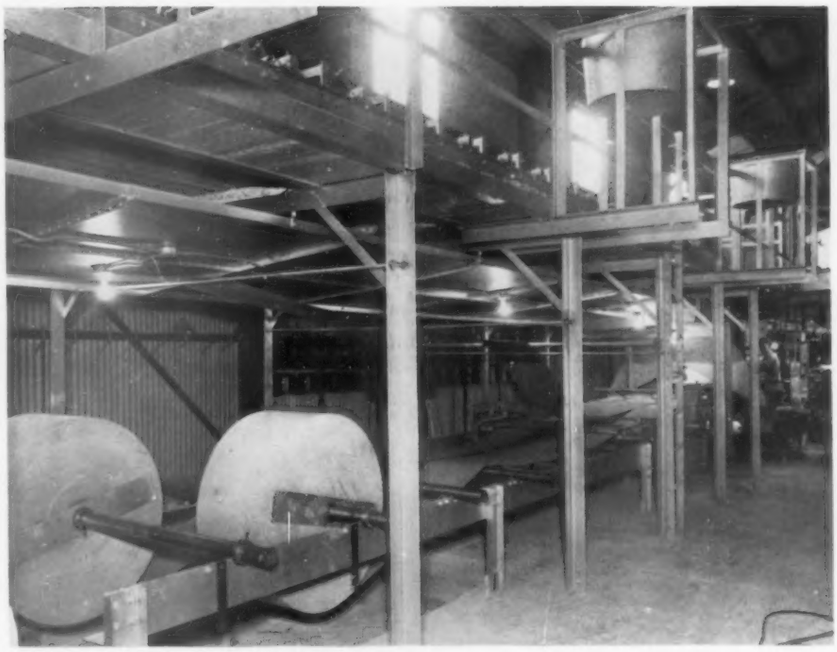
the machine by an overhead Conoco crane and American "Lo-Hed" monorail hoist operated from the floor. The paper rolls, which are 60 in. in diameter and weigh approximately 3,300 pd. each are stored near the board machine, where capacity for 400 tons is available.

The ribbon of board passes from the forming rolls on a 52-in. by 197-ft. centers flat rubber belt-conveyor. Following this is another belt-conveyor section 197 ft. long between centers. Boston Woven Hose & Rubber Co. board-machine type belts with a specially-finished smooth surface are used. Next the board travels 248 ft. over driven and gravity roller sections. The entire board-machine line is 548 ft. long and a single 20-hp. Hi Torque motor drives all the belt and roller sections. A silent chain connects the motor to an inclosed-type Lewellen variable-speed unit, and another silent chain drives a line-shaft underneath the board-machine frame. The belt-conveyor sections are driven from this shaft through De Laval worm-gear reducers and roller chain. It also drives a second line-shaft, from which the driven roller sections are operated through spiral gears.

The board travels over this conveyor system at various rates of speed, and by the time it reaches the end has set and hardened sufficiently to be cut. At the end of the roller section is a Knowlton cut-off knife, which automatically cuts the board into the desired lengths for boards or lath.

At the end of the roller section an Ehrsam lath punch is installed. In the manufacture of standard-width wallboard or lath the punch is in operation, but in the manufacture of gypsum perforated lath the perforations are automatically made by this special machine. This machine is kept in step with the speed of the board machine by the use of a Reliance Syncrolok generator operated from the Lewellen variable shaft, which imparts to a Reliance Syncrolok motor on the Ehrsam punch the proper speed characteristics to keep it "in step." The Knowlton knife is driven from the power shaft of the Ehrsam punch, insuring at all times that the perforations are properly spaced in relation to the length of the lath.



Feeding paper to the board machine.

An accelerating-roll section spaces the boards far enough apart so that the Coe automatic-transfer section can move them across to the drier tipple feeding the various decks of the drier. The entire transfer section and the tipple are automatically controlled through photoëlectric cells and other types of electric controls. The 8-deck Coe drier or kiln is 230 ft. long and has the latest types of circulating fans and heaters with thermostatic control. Two widths of board, or six widths of lath, are carried on each deck. This machine is continuous. The temperature in each of its three zones is automatically regulated. The wet and intermediate zones have steam coils above and below each deck and the final zone has circulating fan heaters only. All the circulating ducts are supported on the top of the drier. The conveyor rolls in the drier are operated through a new type of kiln jack by a continuous chain on each of the 8 decks for the full length of the drier. The drier and duct are insulated and operate on low-pressure steam.

The finished boards or laths are taken off the 8-level drier take-off by hand, inspected, and piled on wooden-deck steel-frame pallets for storage. They are then bundled and labeled with the Gold Bond brand by special types of bundling machines for the different grades of board and lath. Lift trucks pick up the loaded skids and carry them into the warehouse or into box-cars for shipment. The warehouse has storage space for over 1,500,000 sq. ft. of lath or wallboard. There is also storage space for fiber insulating board from the company's new plant at Mobile, Ala., and metal lath from its plant at Niles, O.

The board machine now has a capacity of 300,000 sq. ft. in 24 hr. The drier capacity is now 250,000 sq. ft. in 24 hr., but can readily be increased to produce 300,000 sq. ft. daily.

The plaster and gypsum mill and the board mill are located with railroad tracks between them and are connected to the main-line tracks of the Savannah

Automatic transfer and tipple following the plaster-board drier.

GRINDING GYPSUM

85% Minus 100-Mesh at 12 Tons Per Hour

with the RAYMOND Low-Side Roller Mill

WHENEVER an important new plant is equipped or an old one modernized, the wide preference for Raymond Roller Mills is recognition of their all 'round dependability and long-term economy.

In a recent installation, two of the latest type Raymond Low-Side Roller Mills with air separation are used for pulverizing Nova Scotia gypsum rock. Each mill has its own automatic motor-driven feeder and is equipped with a cyclone collector and tubular collector to catch the fine dust. The material is handled in an enclosed system under suction. This assures dustless operation and maximum recovery of the product.

The Low-Side Roller Mills are standard equipment in the nonmetallic-minerals industry for grinding to average commercial fineness, as required in reducing phosphate rock, limestone, bauxite, clay and similar materials. Capacities up to 40 tons per hour . . . at record low power costs per ton.

Write for Catalog No. 34

RAYMOND PULVERIZER DIVISION
COMBUSTION ENGINEERING COMPANY, INC.
1321 North Branch Street CHICAGO

Sales Offices in Principal Cities
Canada: Combustion Engineering Corp., Ltd., Montreal

& Atlanta Railroad. Eighteen cars can be loaded under cover simultaneously and there are several loading docks inside for trucks. Mixed products can also be loaded conveniently with various commodities in one car.

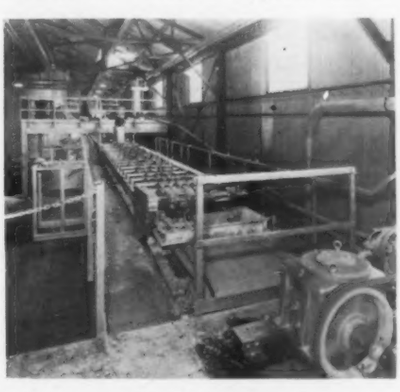
The steam used in the Coe drier and for heating the fuel oil is supplied by a Combustion Engineering Co. steam-generator type boiler rated at 400 hp. This boiler is oil-fired by means of Todd burners. Natural draft is created by a 125-ft. Rust radial brick stack, although forced draft can be used on the boiler. The oil used for firing is brought into the plant yard in railroad tank cars and is pumped into a 50,000-gal. tank. It is heated and pumped to the oil-fired kettles, rock drier and boiler through underground pipes. Todd oil-handling equipment is used.

The water used in the processing and for the Grinnell dry-type sprinkler system in the plant is obtained from a 650-ft. well which was drilled by the Layne Atlantic Co. A Layne heavy-duty, deep-well turbine pump supplies water at the rate of 600 g.p.m. to a Chattanooga 100,000-gal. steel tank on a 165-ft. tower. The casing of the well is sealed with a concrete jacket. Sprinkler fire protection is provided in the board plant and plaster warehouse.

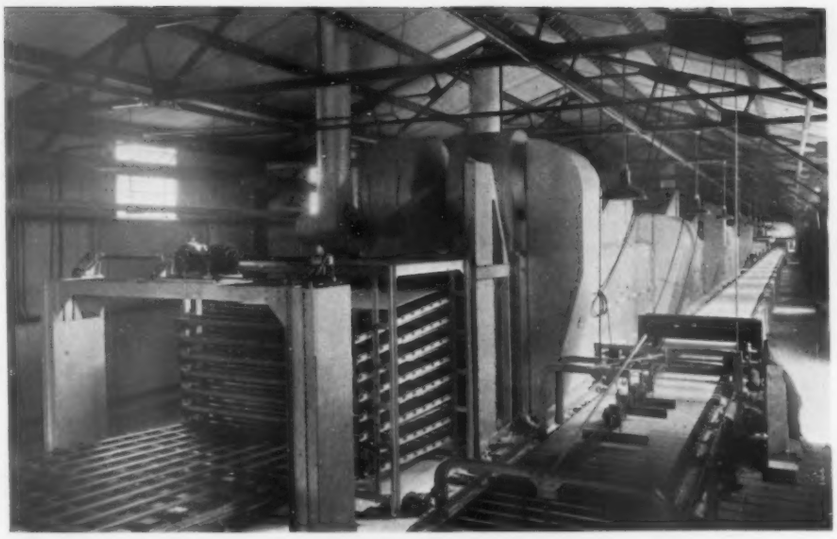
Special mercury-vapor lamps have been installed for night operation. These lamps furnish daylight intensity and distribution of light to control the quality of products so the work done at night will be on a par with the daytime production. Power for the plant is supplied by the Savannah Electric & Power Co. The 13,000-v. current is reduced in a substation and transformer-house to 440 v. Further reduction for lighting is also done by transformers from the power circuits.

A modern air-conditioned building contains the plant office and laboratory. An 8-ft. steel Cyclone fence incloses the plant site.

The new Savannah plant was designed completely by the engineering staff of the National Gypsum Co. in collaboration with the technical staff of the George A. Fuller Co., which held the general contract. All the buildings have structural-steel frameworks with corrugated-metal siding and roofing, Truscon steel window sashes and doors, and concrete floors and foundations.

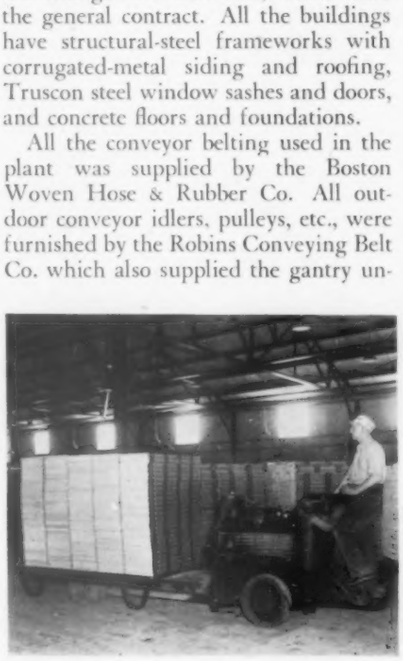


Soak belt carrying hydrated pulp to mixer. Foam-solution generator in middle background.



Feed end of plaster-board drier.

All the conveyor belting used in the plant was supplied by the Boston Woven Hose & Rubber Co. All outdoor conveyor idlers, pulleys, etc., were furnished by the Robins Conveying Belt Co. which also supplied the gantry unloader and the stacker. The Link-Belt Co. supplied most of the speed-reducers, the roller-chain and silent-chain drives, the bucket-elevators, the screw-conveyors, the drag-chain conveyors and feeders, all the inside belt-conveyors, etc. The Allis-Chalmers Mfg. Co. supplied the Texrope drives. The Joseph T. Ryerson Co. furnished all the elevator and screw-conveyor housings and the structural framework for the board- and soak-belt machines. The Steel Products Co. and the Ingalls Iron Works Co. furnished all the steel and fabricated parts for the buildings. Ingersoll-Rand air-compressors are used.



Lift truck depositing skid of plaster-board in warehouse.

All the electrical installation work was done by the Beacon Electric Co., Buffalo, N. Y. The General Electric Co. supplied all the electrical and control equipment and magnetic-type starters for all the motors. Of the 125 new motors purchased, 15 were of the wound-rotor type. The motors are about equally divided between General Electric and Westinghouse.

Reveals Discovery of Shortite—New Mineral

Discovery of a new mineral, officially named "shortite," has been announced by the U. S. Geological Survey.

Composed of a double carbonate of sodium and calcium, the new mineral was found and identified by J. J. Fahey, chemist, in the Geological Survey Laboratory. It was discovered as disseminated well-formed crystals in sections of core from the John Hay oil and gas well, drilled by Mountain Fuel Supply Company on leased Government land in Sweetwater County, Wyoming, at depths of 1,250 to 1,800 ft. below the earth's surface. Shortite was named in honor of Dr. M. N. Short, a former geologist of the Survey who now is Professor of Optical Mineralogy at the University of Arizona.

Although the commercial value of "shortite" is not yet definitely known, the new mineral is associated with considerable quantities of trona, sodium carbonate-bicarbonate, which does have potential commercial value. Trona was identified in a sample from this same well in 1938 by R. C. Wells, chief chemist of the Geological Survey.

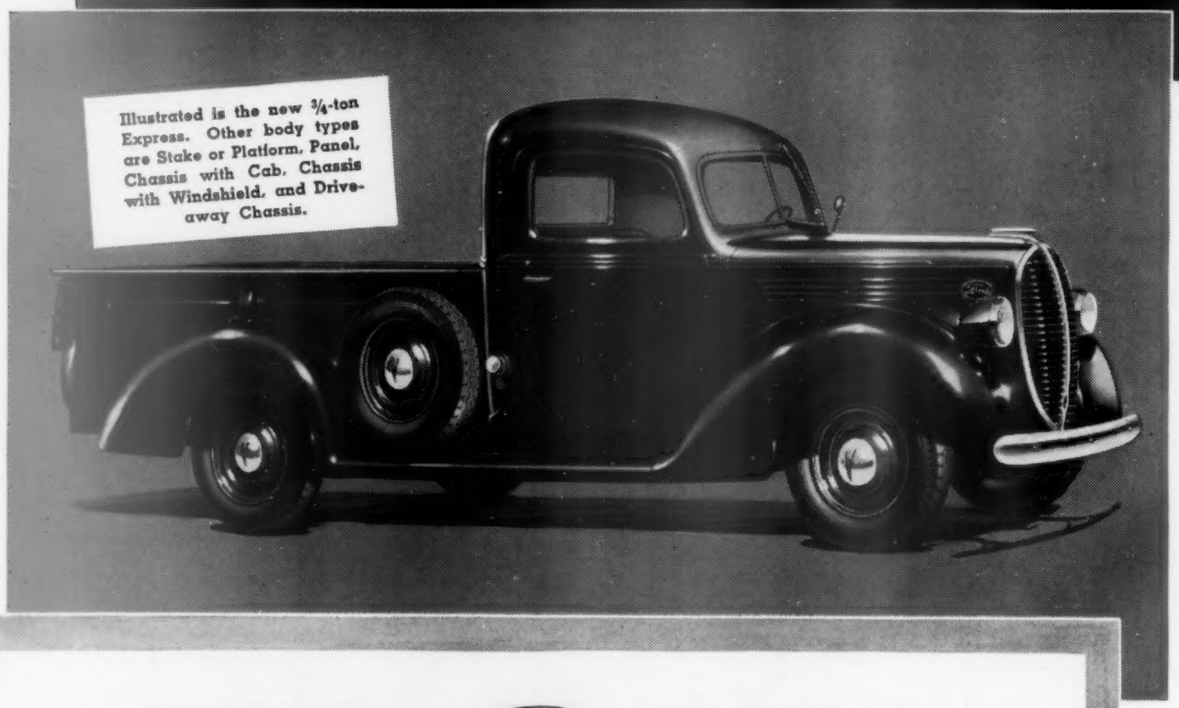
The new find probably will be one of the few mineral discoveries for the year. So thoroughly has the earth been combed that, during the past two years only about twenty new minerals were discovered in the entire world.

A BRAND-NEW MEMBER

BROADENS THE LINE OF FORD V-8 TRUCKS

THE 3/4 TONNER

122-inch wheelbase—60 or 85 horsepower V-8 engine


Illustrated is the new 3/4-ton Express. Other body types are Stake or Platform, Panel, Chassis with Cab, Chassis with Windshield, and Drive-away Chassis.

The new Ford V-8 3/4-ton Truck brings to the hauler of lighter loads a better opportunity than ever to choose a unit exactly fitted to the needs of his job in power, size and body type.

The new truck is low in price, with exceptionally large body dimensions that will appeal to any one whose loads are in the 3/4-ton range.

It is sturdy, carefully designed and well built. All 3/4 Tonners have full-floating rear axles. Ask any Ford dealer to arrange a free "on-the-job" test for you.

The Ford V-8 line now includes Commercial Cars, 3/4 Tonners, One Tonners, Regulars, and Cab-Over-Engine models. 48 body and chassis types, 3 V-8 engines, 6 wheelbases and a wide selection of optional equipment.

FORD V-8 TRUCKS

FORD MOTOR COMPANY, BUILDERS OF FORD V-8 AND MERCURY CARS, FORD TRUCKS, COMMERCIAL CARS, STATION WAGONS AND TRANSIT BUSES

New Stock-Piling System at Valmeyer Keeps Plant Independent of Mine

THE policy of the Columbia Quarry Co., St. Louis, Mo., has always been to maintain each of its plants at "peak" efficiency. This is done by making improvements whenever the need for them becomes apparent and doing this work in such a way as not to interfere with operations. The effect of this policy is evident in each of the company's plants and especially at the Valmeyer, Ill. plant with which this article is concerned. The latest improvement is a stock-piling system between the primary and secondary crushers which keeps the plant independent of the mine and also takes advantage of gravity in bringing the stone down to the plant level.

Gasoline locomotives and cars were formerly used and these hauled the stone from the mine level down to the primary crusher 40 ft. below, hauling the empty cars back up a grade, 10 per cent. in places, into the mine. In March, 1938 this system was replaced by trucks but further changes were found to be necessary. In March, 1939 the new system of feeding the plant was put in operation. The crusher was moved from the plant to the mine opening. Stone is now dumped from the three Mack 7-ton side-dump trucks at mine level into the Allis-Chalmers No. 12 N gyratory primary crusher. The trucks follow a ¾-mi. circle route, coming out of one mine opening and passing over a 40-ft. wood and steel trestle to enter again through another. This trestle was made strong enough so that heavier trucks can be used if desired. A new Curtis air hoist is used to dump the trucks. Two Curtis air hoists over the crusher are used to operate stone hooks. An International TD40 Diesel tractor with a Bucyrus-Erie bullgrader is used to keep up the mine floors and to pile up rock for the shovel after a blast.

View of the plant with mine and stock-piling system in the background.

Truck being dumped by air-hoist. The stock-piling conveyor is at the right.

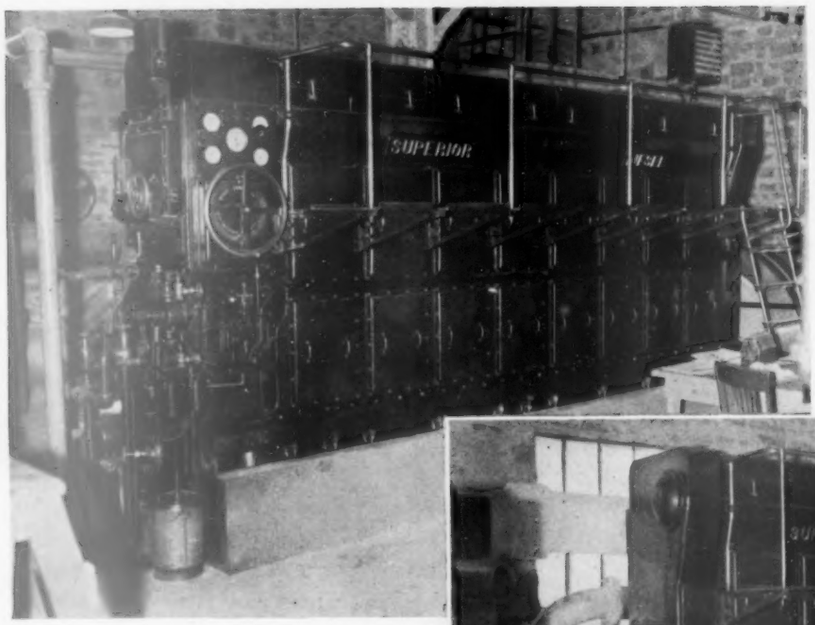
The crusher product is discharged on a 30-in. by 80-ft. inclined belt-conveyor which discharges it on a 4,000-ton stock-pile. About 1,200 tons of stone is reclaimable without handling through a single opening in a concrete tunnel under the pile. A pan-feeder discharges the stone on a 24-in. by 85-ft. horizontal belt-conveyor which carries it out of the tunnel to the plant. Stephens-Adamson belt-conveyor assemblies and feeder and Manhattan conveyor belting are used in this stock-piling system. The tunnel conveyor discharges the stone on a belt-conveyor which formerly took the primary crusher product direct to the secondary crusher.

Secondary reduction of the stone is done by an American 30-in. by 40-in. hammer-mill installed recently and an American ASC No. 2 ring-mill installed eight years ago. The ring-mill had its original rings until April, 1939, when they were replaced, not due to wear but to install an assembly of later design with new rings. In eight years over a million tons of 6-in. minus stone passed through this mill and were reduced to 2-in. minus or smaller.

Screening is done on a 4-ft. by 12-ft. 2-deck Robins Gyrex screen followed by a 4-ft. by 8-ft. 2-deck Niagara screen and a 3-ft. by 10-ft. 1-deck Robins Gyrex screen equipped with sprays for washing. Any size produced can be returned to the mills for further reduction. The various sizes of material produced are discharged into bins. Any size can be discharged on a belt-conveyor followed by a bucket-elevator. This feeds a 5-roll, high-side Raymond mill which is in closed circuit with a 5-ft. Raymond cyclone.

The plant has a capacity of 1,000 tons in 9 hr. Other products made are local road stone, flux stone, stone for lime manufacture, various sizes of pulverized stone for roofing and asphalt fillers, etc. The rock is very low in silica and fractures easily.

Two miles south of Valmeyer the company has a deposit of a pure white limestone which runs 97.5 per cent. $CaCO_3$ and .06 per cent. iron oxide and is low in magnesium. For some years stone quarried from this deposit had been hauled to the Valmeyer plant and processed there.



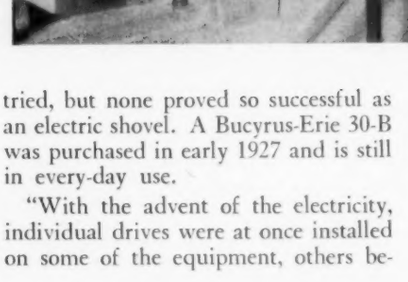
Above—The 8-cyl., 560-hp. Diesel engine. Right—The 6-cyl., 420-hp. Diesel with generator at the left.

Late in 1938 a small plant with a capacity of 12 to 15 tons per hr. was installed at this deposit to produce special grades of stone for the chemical, glass and other trades. The equipment includes Dempster Dumpsters, an Allis-Chalmers Diesel engine and an American 24-in. by 30-in. hammer-mill.

While at the Valmeyer plant the writer was privileged to look over a description of the Diesel-electric power plant at this quarry which had been prepared in December, 1938 by Supt. Fred A. Krewer. In this description Mr. Krewer presents such a clear picture of this installation, the reasons for making it, and the results obtained with it, that we asked for and received his permission to quote from it at length:

"The Valmeyer quarry was opened in 1918 as an open quarry. A steam plant with line shafts throughout was installed and remained in operation until 1927, when a utility company extended its lines to Valmeyer. Heavy overburden on the stone then being quarried presented quite a problem and it was decided to try underground mining. But power also presented its problem. It was realized that steam could not be used underground, air was too costly and hand-loading too slow. As the public utility was already looking into the matter of the extension to Valmeyer, the prospect of an immediate load appealed to it and a connection was made early in 1927. Early in 1926 underground mining was begun and various types and makes of loading equipment were tried, but none proved so successful as an electric shovel. A Bucyrus-Erie 30-B was purchased in early 1927 and is still in every-day use.

"With the advent of the electricity, individual drives were at once installed on some of the equipment, others being put into service later. A yearly high-demand power rate was the first basis used and was carried through the year 1931. With a lessened production following the decline in 1929, and its increased power costs per kw. hr. and per ton, every effort was made to increase the energy consumption to balance the demand or primary charges encountered in all quarries and crushing plants. A pulverizing plant was put in operation late in 1930, as was an additional secondary cursher. Additional markets for different products, and different uses were sought and thereby put off for a time, power costs rising too rapidly. Late in 1932, after the continued decline of production, power costs were now of such importance that all possible thought was applied to solving this problem. Discussions were had with power representatives and after different rates or bases were tried (and all to no avail) it became necessary in 1933 to control our power costs if at all possible. This was done by regulating the amount of stone crushed through the plant within a given period, by operating the plant between certain hours and by operating only one unit of the plant operation at any time. No machine or unit was started until all else was shut down. Thus the "bugaboo" of all crushed-stone plants, namely the "primary charges," were kept down to the minimum. Even then the costs per ton for power were at least 75 per cent. higher than under a normal year or output. With increased production after 1934 this was relieved to a slight extent, but power costs were still much higher than normal. And, further, we were still operating on a split-unit basis, the different mill or units were operated on separate shifts, always to keep down our primary costs.



Primary gyratory crusher with air-hoists which operate the stone hooks.

Ring-mill installed 8 years ago to produce pulverized limestone.

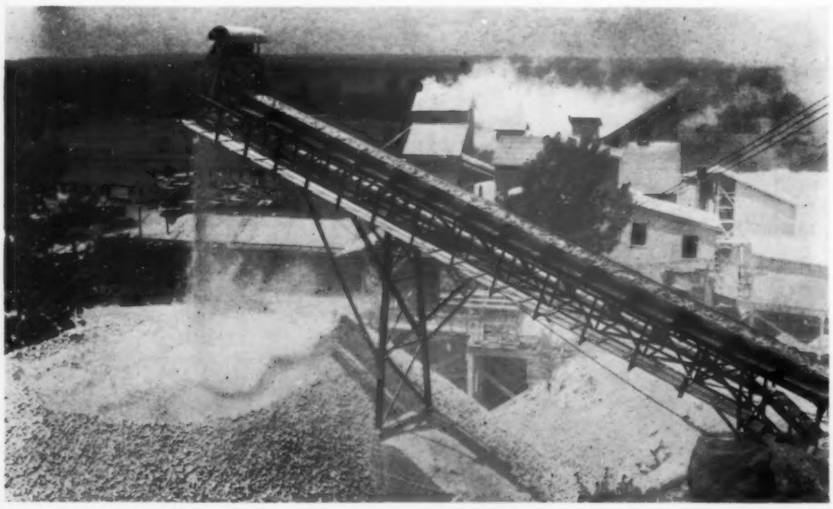
"From the time of the power-line extension into Valmeyer through the year 1936, electric rates for domestic uses were reduced nearly one-half, but the rates to industrial users continued the same. From yearly demand to monthly demand and on different bases, when the bills were figured in several different ways, they came out nearly alike. After conferences with power representatives in 1935 and 1936 at which we asked for lower rates, which were always eventually refused, the Columbia Quarry Co. notified the power company that, upon the expiration of their joint contract, the quarry would not renew it and would not require any future power. A contract was signed somewhat later with the National Supply Co. for an 8-cylinder 12½-in. by 15-in. Diesel engine for delivery in 1937. This unit was installed and ready to go on June 1, 1937. With increased production through June, 1938, and a possible continued increase until winter in sight, this engine was not sufficient to carry the entire plant at one time and so a second Superior engine was purchased and operated from early September, 1938. A larger hammer-mill was installed in 1938 and this further increased the power requirements.

"The engine room at the Valmeyer quarry now contains a 560-hp. and a 420-hp. Superior Diesel engine. The 8-cylinder engine is connected to an Allis-Chalmers 485-kv.-a. 60-cycle, 3-phase generator, and the 6-cylinder engine is connected to a 364-kv.-a. generator of the same make. Both these engines are of the YLO type and operate at 400 r.p.m. The kilowatt rating of the generators at 80 per cent. power factor is about 680. The present normal load is approximately 450 kilowatts with some increase from the electric shovel which does the loading in the underground mine at this quarry.

"As the quarry operates the year 'round, an indoor heat-exchanger system was of necessity employed and has proved satisfactory. The soft water is circulated from the engine through the heat exchanger entirely within the engine-room itself, only the raw water being sent outside to the cooling tower. The pumps are driven by a single-shaft electric motor, a centrifugal pump on each end, one for the raw water and one for the soft water. Each engine has its individual pumps. The circulating lines to the outside are covered in the fall and winter to prevent freezing. As the original 8-cylinder engine provided two air receivers for engine starting, this was deemed sufficient to take care of the second engine and no additional receiver was installed. The 15,000-gal. fuel-oil tank was also installed originally and this serves both engines. The fuel inlet line from the storage tank connects to both engines when the fuel-oil pumps send it to the day tanks. Separate lines from the day tanks to each engine serve the high-pressure fuel pumps and each day tank has an overflow line which connects and carries the overflow back to the storage tank which is set 2 ft. lower than the day tanks. Standard Oil Co. special Diesel fuel oil of 28-30 gravity is used.

"The lubricating-oil system is served by a small overhead tank for each engine. The oil flows from the tank to the high-pressure lubricating-oil pump which forces it throughout the engine, whence it gathers in the crank case, is picked up by a second lubricating-oil pump and forced through a Nugent filter, then through a lubricating-oil cooler and thence to the storage tank. Approximately 80 gal. of fuel oil is contained in the 8-cylinder circulation system and 70 in the 6-cylinder. The lubricating oil is run 400 hr. and the engines are then thoroughly cleaned and fresh oil is put in. The used oil is put into a dirty-oil tank installed alongside a Hilco oil reclaimer, and whenever a batch or two of dirty oil is in the tank the Hilco is started and reclaims the oil for the next change. Lubricating oil costs, due to the excellent reclaiming of the Hilco, have been reduced by half, and, no doubt, better lubrication is possible due to the frequent oil changes. Many Diesel operators use only new oil in their lubricating systems, and allow it to be run 1,000 hr. or even longer. Make-up oil, of course, refreshes the circulating oil to some extent, but as some make-up oil is added during our 400-hr. period, much less contamination by minute carbon particles (due to the shorter hours of use) results. On the 8-cylinder engine we pulled the pistons at about 4,000 hr. of operation, and due to the little carbon encountered not only on the piston and around it, but on the rings and in the ring grooves it was necessary only to clean the grooves, rings and pistons and replace them. The rings and pistons and replaceable

New 30-in. by 40-in. hammer-mill installed for production of pulverized stone.



Belt-conveyor which stock-piles the crusher product.

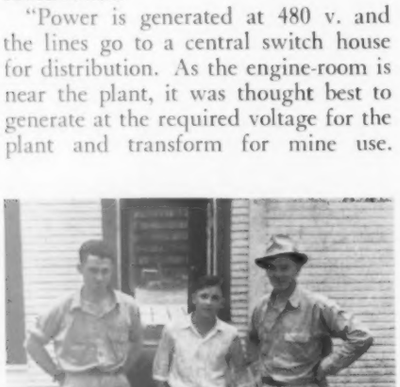
liners in the engine showed no appreciable wear and were all put back and are still operating. The lubricating oil used is Standard Non-Pareil heavy. Oils, other than Diesel lubricating, are also reclaimed and tests made of reclaimed oil compare very favorably with new oil as to sediment, acid and other deleterious matter.

Switchboard and control equipment for the Diesel engines.

"Due to the lime dust in the raw water used for cooling purposes, the heat exchangers must be cleaned once a year. This is done by circulating a water and Oakite mixture through the exchangers for about 4 hr. The lines to and from the cooling tower have not been cleaned thus far, as it appears to be the hot water which causes the sealing in the exchanger.

"The engine room is heated by steam from a regulated-pressure boiler (in a room to itself), with two radiator-blower units in the engine-room. These also are automatic and control the temperature desired in the engine-room. The engine and machine shop buildings are of fire-proof natural-stone construction.

"Power is generated at 480 v. and the lines go to a central switch house for distribution. As the engine-room is near the plant, it was thought best to generate at the required voltage for the plant and transform for mine use.



Earl Pflasterer, engineer; Joe Krewer; and Fred A. Krewer, superintendent.

Thus, a line runs to a bank of three transformers, where the voltage is stepped up to 7,300 to 7,500 for transmission to the mine. A pole line carries the current up the hill and on across to a hole near the face of the mine workings, where the power is transformed to 480 v. This sub-station is on the surface above the workings and the power is carried down into the mine through heavy copper conductors. From here it is run to various switch boxes to which the shovel is connected. The lights in the mine are fed from this 480-v. mine-line, the current being first transformed to single-phase 110-v.

"The shovel is a Bucyrus-Erie 30-B with a 1¼-cu. yd. bucket. It is a straight a.-c. power machine having a 75-hp. hoist motor, a 30-hp. swing and a 30-hp. crowd motor. It also contains a small electrically-driven air-compressor for brake and clutch control. The hoist and crowd motors, which are 'on the line' at the same time, take a 'peak' demand of as much as 250-hp. when encountering hard digging. This is, of course, just for a short interval, the current used decreasing considerably as soon as the stone and dipper are in upward motion.

"Haulage is now done by trucks, AC Macks being used. The drilling is done underground with Gardner-Denver AF 79 automatic drifter drills, of which four are in constant use. The air for drilling is furnished by a Sullivan angle compound, air-compressor of about 750-cu. ft. capacity. It is driven by a 150-hp. synchronous motor with a separate exciter. This machine is located in the engine-room and a 4-in. line runs from there to the mine receiver with small lead lines to the working faces. Air-lines also lead to the various plant buildings.

"Besides the motors on the shovel, and a 10-hp. light transformer in the mine, the various connected loads comprise:

Crushing and screening plant	435 hp.
Pulverizer plant	120 hp.
Engine-room	217 hp.
Fine crushing plant	90 hp.
Car-puller	30 hp.
Shop and lights below	15 hp.
Total connected load	1,052 hp.

of which ordinarily about 850 to 875 hp. is on the line to some extent when all units are operating. Much of the excess connected load is in motors used on various conveyors, and elevators which are only used at times.

"We have found Diesel power for a quarry and crushing plant as satisfactory in every respect as purchased power. We have had the advantage of operating as much as we wish, or when or how we wish, and without having to take into consideration the power costs at the end of the month. We can operate all or a part, one or two shifts as conditions warrant. Our plant power costs have been cut over 50 per cent. besides other savings possible. During the year 1938 we produced about 1,100,000 kw.-hr. of current and every indication points to an increase for 1939. Nearly every stone plant is 'bad medicine' as far as power loads are concerned, mainly due to high 'peaks' of demand and the large amount of energy required in the crushing, loading and drilling of the stone."

Gilsonite Production Centered in Utah

Gilsonite, a native asphaltite 98 to 99.9 per cent. pure, characterized by a hardness of 2 (Mohs), a specific gravity of 1.01 to 1.10, and a melting point of 230 to 400 F. (K. and S.), is mined commercially only in northeastern Utah. It occurs in almost vertical veins from a few inches to 18 ft. wide and 8 to 30 mi. long that cut across the Tertiary limestone and shale of the broad Uinta Basin. The bitumen is believed to have been distilled by heat from oily material in the underlying Green River shale.

At the Rainbow mine of the Gilson Asphaltum Co. (General Asphalt Co.) the gilsonite, formerly extracted in an open cut by a system of stopes and benches, is now mined by shafts and horizontal drifts. Little timbering is required. The mining methods of the Raven Mining Co., of Chicago, and of the American Asphalt Assn. and the Utah Gilsonite Co., both of St. Louis, are equally simple. To avoid dust explosions and shattering of ore, explosives are little used. The brittle gilsonite is dug out with picks, hand-selected, sacked, and hoisted to the surface.

"Select gilsonite" and "jet asphaltum" are used principally in the manufacture of varnishes and japans, printing and rotogravure inks. "Standard gilsonite" is employed in the manufacture of storage-battery cases and molded articles, brake linings, tile and mastic, sealing compounds, insulation, and wood stains. Weathered gilsonite from the surface is used to saturate roofing felt and for blending with rubber.

Sales of gilsonite by producers reached a peak of 54,987 short tons in 1929, declined to 25,955 tons in 1932, and has since been rising. Since 1925 the value, f.o.b. mine or shipping point, has ranged from $19.43 to $22.00 per ton, averaging $20.91.

Two A.S.T.M. Sessions Devoted to Cement, Concrete, Gypsum and Lime

WITH more actions being taken on standards than at any other meeting and with a registered attendance of members, committee members and visitors second only to the meeting in New York two years ago, the forty-second annual meeting of the American Society for Testing Materials held in Atlantic City, June 26 to 30, was noteworthy. The registration of 1,354 was higher than for any other meeting and exceeded only by the attendance of 1,523 at New York in 1937, the latter figure being augmented by a larger than the average number of visitors.

Two full sessions of the meeting were devoted to the subjects of cement, concrete, lime, and gypsum with a number of committee reports and technical papers in both the sessions.

One of the outstanding developments in these sessions was the failure to accept the proposed tentative test for autoclave expansion of Portland cement on which there has been intensive discussion for the past two years. A vote of the session in which the C-1 Committee report was presented lacked the necessary two-thirds of approving a motion to accept the test as a new tentative standard. The report of Committee C-1 was approved, including revision of the tentative method of chemical analysis of Portland cement giving new alternate methods for determining free calcium oxide and also the immediate adoption of the deletion of the final setting time requirement in the standard specifications for high-early-strength Portland cement. A test for specific gravity will be added to the Methods of Sampling and Testing Portland Cement (C 77-37) subject to favorable letter ballot vote in the society.

An interesting part of the report was the results of tests on comparative Sample No. 2 of the Cement Reference Laboratory. Those participating included laboratories which had taken part in recent inspection work of the Reference Laboratory, and in addition to the physical tests the work included autoclave expansion, turbidimeter fineness, compressive-strength determinations and chemical analysis. All told, 161 laboratories took part.

Dr. M. N. States, Central Scientific Co., in his paper on *Specific Surface and Particle Size Distribution of Finely-Divided Materials* developed general equations for specific surface and particle size distribution of finely divided materials. Through the use of these equations the Wagner method may be applied to fineness studies in which various particle size ranges are used. Corresponding expressions for the Portland cement schedule may be derived from the general relationships. Analysis of the fundamental principles of the Wagner method, the working equations and various sources of experimental error indicate that the accepted experimental technique may be considerably simplified. An instrument and accessories were described which lend themselves to the use of the simplified procedure for fineness measurements.

Committee C-7 on Lime took action to combine into a single specification existing requirements for Quicklime (C 53) and for Hydrated Lime (C 54) both for use in water treatment. One action taken clarified the definition of hydrated lime which is to read as follows:

> *Hydrated Lime.—A dry powder obtained by treating quicklime with water enough to satisfy its chemical affinity for water under the conditions of its hydration.*

Jointly, by action of Committee C-11 on Gypsum and C-7 on Lime, the Tentative Specifications for Sand for Use in Plaster (C 35-36 T) were adopted as standard with some revisions.

Messrs. Miller, Rogers, and Manson of the University of Minnesota in their paper covered a flow method for the determination of the effects of soluble chemicals on concrete. The conclusions of this paper are based on results obtained by allowing weak solutions of acetic and lactic acids to flow across flat slabs of concrete and mortar set nearly vertical. In most cases, paraffin dykes restricted the flow of acid to an area 14 in. long and 1½ in. wide. In other cases, laboratory-made bars 2½ by 3 by 15 in. were cast with slightly depressed 1½-in. lengthwise channels. The hydrostatic head on glass capillary tubes was adjusted to deliver to each channel 2 liters of acid every 24 hr. Each channel was brushed with a flat steel brush about the size and shape of a 1-in. paint brush, and the loosened material was caught in filter-paper lined funnels, oven-dried, and weighed.

Concrete with a modulus of rupture from 800 p.s.i. upward displayed resistance to corrosion of weak acids three times that of concrete with a modulus of rupture of 500 p.s.i. under the conditions of exposure used in these tests.

Mortar made of the least resistant of nine standard Portland cements yielded a quantity of loosened material 1.6 times that released by mortar made of the most resistant of these nine cements.

An interesting paper by Ernst Gruenewald of the Lone Star Cement Corp. described a study of the effect of cement content, cement fineness on compressive strength, durability, and volume change of concrete. Primarily, the properties of lean concrete mixes were investigated. One Portland cement ground to three different finenesses, represented by specific surface areas of 1745, 2160, and 2520, and one high-early-strength Portland cement ground to two finenesses of 2440 and 2655 were used.

In addition to the study of plain concrete mixes, the effect of adding an inert admixture to the lean mixes was investigated. This admixture was ground limestone such as is occasionally used as filler material.

Seven plain concrete mixes with cement contents ranging from two to six bags per cubic yard were used. Six concrete mixes were made with the filler. Enough of the filler was added to each mix containing less than five bags of cement to make the sum of the absolute volumes of cement and admixture equal to that of five bags of cement.

Quite a number of conclusions were reached as a result of this very extensive work. The paper will be published in the society's *Proceedings*.

The water-cement ratio was shown by this investigation to govern not only strength but also durability of concrete. It also determines the amount of cement necessary in concrete to produce a given workability.

The modern cements produce a 28-day strength of 2,000 p.s.i. with a water ratio of 1.34 to 1.46 as compared

to 1.0 for cements 20 years ago. Thus, if strength alone were considered, the cement content for a 2000-pd. concrete could be reduced to 3¾ or 3¼ bags per cu. yd., but due to the high water ratio of such mixes the resulting concrete will be of low durability. Therefore, in order to assure adequate durability of concrete exposed to weathering, a maximum water content should be specified regardless of the strength produced by such concrete.

Quite an extensive report was submitted by Committee C-9 on Concrete and Concrete Aggregates, its actions including immediate adoption of a number of revisions in standards and the adoption of several tentative standards as standard, items in the latter category covering concrete aggregate, lightweight aggregate, and tests for coal and lignite in sand; specific gravity and absorption of coarse aggregate, fine aggregate; sieve analysis of fine and coarse aggregates, yield of concrete, and abrasion of coarse aggregate by use of the Los Angeles machine. A considerable portion of the report is devoted to appended papers, one by C. E. Wuerpel on *Modified Procedure for Testing Concrete Aggregate Soundness by Use of Magnesium Sulphate,* which is intended to overcome certain difficulties in the existing Method of Test for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate (C 88-37T) and a paper by Ira Paul recommending a test method for organic impurities in washed sand by pH value. Mr. Paul claimed certain advantages in favor of the method as follows:

1. Within a period of 15 min. the laboratory technician can obtain reliable tests indicating the effect of organic impurities in fine aggregates by means of the hydrogen-ion apparatus (determined as change in pH of standard lime solution).

2. The personal factor is eliminated, and accuracy is assured. The hydrogen-ion apparatus is very sensitive to any chemical change within a working range of 0.03 pH.

3. The apparatus is usually found in any up-to-date chemical control laboratory.

There was also extended discussion in the form of an appended paper by Prof. W. M. Dunagan detailing *Methods for Measuring the Passage of Water through Concrete.*

The new information secured by tests in this study is that capillary movement of water through concrete may be of a greater magnitude than that of free liquids at ordinary heads; it is shown that for that reason permeability tests which operate at such heads (less than 10 ft.) measure mostly capillarity. Thus low-head tests may show concrete containing water-repellent materials to be more resistant to capillarity than standard Portland cements because their surface tension characteristics have been altered. Such tests do not necessarily measure the ability of these concretes to resist the passage of liquid water.

In a paper by Prof. H. J. Barre covering *Some Observations of the Water Vapor Permeability of Concrete* the author concluded, as a result of a series of tests, that moisture losses from untreated surfaces of concrete tanks which emerge in the form of vapor raised the question as to the method by which moisture passed through concrete. The latter tests clearly indicated that the concrete was permeable to water vapor even when no liquid was in contact with the surface. Other correlated tests clearly showed that this same concrete would permit the passage in the amount by the action commonly referred to as capillarity. This series of tests seems to have the value in establishing at least tentatively the magnitude of vapor and capillary resistance of the type tested under conditions of these tests.

In the author's opinion the data on rates at which moisture passed through the specimens (ranging from 0.0156 to 0.0274 g. per sq. ft. per hr.) indicate that the higher strength mixes as well as those of lower strength are permeable to water vapor, although to less degree, even though they are known to be impermeable to liquid water under high pressure.

A rather interesting study of some 1,100 miles of concrete pavement in Kentucky was the basis of a paper by Messrs. Cantrill and Campbell of the Kentucky Department of Highways on the subject *Selection of Aggregates for Concrete Pavement Based on Service Records.* They concluded that:

1. The failure of concrete pavement throughout the western part of the state was due to the use of chert gravel obtained from the Tennessee and Cumberland Rivers in western Kentucky.

2. With the present methods of pavement construction, this chert gravel will not produce durable pavement.

3. Chert gravel found to produce unsatisfactory pavement in Kentucky may be eliminated by two specifications: (a) Coarse aggregate shall not show an absorption greater than 3 per cent. when subjected to A.S.T.M. Standard Test C 95-36. (b) Concrete in which any aggregate is incorporated shall not show a reduction in flexural strength greater than 30 per cent. when subjected to 40 cycles of freezing and thawing in the presence of water.

4. Tennessee or Cumberland River sand will produce durable pavement when used with Ohio River gravel or crushed limestone.

5. The use of sandstone as both fine and coarse aggregate resulted in unsatisfactory pavement.

6. The use of sandstone and Ohio River sand as aggregates resulted in satisfactory pavement.

In connection with thermal volume change and the elasticity of aggregates and their effect on concrete T. F. Willis and M. E. De Reus of the Missouri State Highway Dept. described an inexpensive apparatus used in the series of tests and indicated that tests on the two principal types of coarse aggregate used in Missouri show:

1. That the thermal expansion coefficient of expansion of limestone is materially smaller than that of chert.

2. That the modulus of elasticity of both limestone and chert is highly variable, even for material from the same source, but that, in general, the modulus of limestone from any one deposit is more uniform and considerably smaller than the modulus of the preponderance of the chert from any single source.

The data on the mortars are too limited to permit any very definite conclusions. However, it is indicated:

1. The thermal coefficient of the sand is one of the principal determinants of the thermal coefficient of a mortar made from it.

2. The modulus of elasticity of a mortar specimen is affected by the modulus of the sand contained in the mortar and is probably a function of this and the strength of the specimen.

3. The plastic flow of a mortar is closely related to its modulus of elasticity.

Bert Myers of the Iowa State Highway Commission recorded data on *The Effect of Variations in Method upon the Results of Freezing and Thawing Mortars.*

Four different methods of freezing-and-thawing treatment were applied to groups of mortar prisms representing three brands of cement. The proportions, kind of aggregate, water-cement ratio, curing treatment and age were the same for all specimens. The effect of 100 cycles of each method upon the transverse strength, the compressive strength, and the weight of the specimens was determined.

This paper reported a few data which seem to indicate that, while the destructive effect of freezing may be proportional to the rate of cooling, the effect of heating may be more nearly inversely proportional to the rate at which the temperature is raised.

Personal Mention

HENRY W. PETERSON, general manager of the Strathman Sand & Gravel Co., of Woodbury, N. J., was named chairman of the South Jersey Port Commission at a meeting at Camden June 20. He succeeds the late Albert C. Middleton who died in March.

L. G. MEED, proprietor of the Carolina Ice & Fuel Co., Elkins, N. C., has established a concrete-products plant in an addition to his present building. Both gravel and cinder blocks are to be produced.

FRED LAMM, formerly of Schiller Park, Ill., has gone into the business of manufacturing concrete burial vaults at Owensville, Ind.

JOHN H. LOGAN has sold the Blackstone Quarries, Centralia, Wash., to GEORGE W. MCKENZIE.

FRANK S. O'NEIL has been appointed general manager of the Link-Belt Co. plants in Indianapolis, of which he had been assistant general manager for the last seven years.

MARIANO DE MAGISTRIS, 76, president of the Providence Crushed Stone & Sand Co., Inc., Providence, R. I., died recently. He was a native of Italy, coming to the United States in 1890. He entered the crushed-stone and road-building business in 1895.

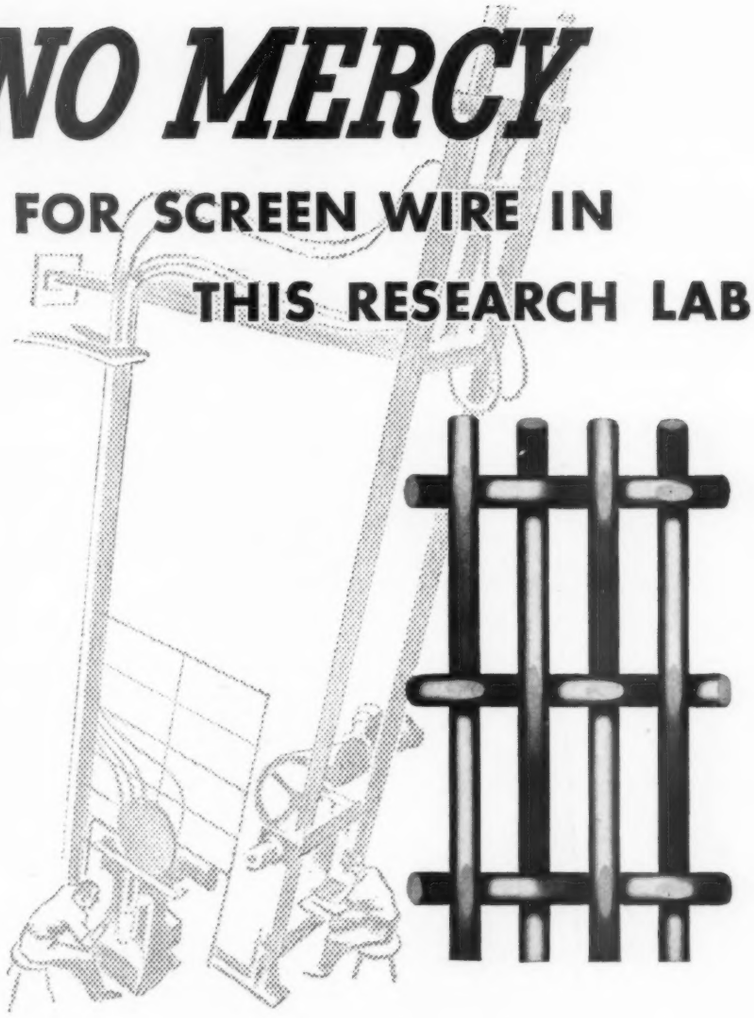
ELLIS OWENS, for 25 years manager of the Carbon Slate Co., Slatington, Pa., passed away a short time ago at the age of 65.

ROY L. COOK, 38, employed for 22 years in the office of the Alpha Cement Co. in Washington, N. J., died at his home there June 29 after a brief illness. He leaves his wife, his father, two sons, a brother and four sisters.

LINCOLN M. THOMPSON, 57, head of the Thompson-Young Sand Co., Jefferson City, Mo., died recently, a victim of coronary thrombosis.

NO MERCY

FOR SCREEN WIRE IN THIS RESEARCH LAB!



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TRADE NOTES

Good Roads Machinery Corp., Kennett Square, Pa., has been granted exclusive rights for the manufacture and sale of the Speed Dumper, truck hoist and multiple bucket equipment for loading, hauling, and dumping earth, rock, etc. Speed Dump, Inc., New York, N. Y., was the original maker.

Price schedules just issued announce another reduction in the price of TDA—the fourth in four years. This constant price lowering, Dewey & Almy Chemical Co. states, is made possible by the manufacturing economies resulting from increased production and technological improvements, and reflects the company's policy of passing these manufacturing savings along to the consumer.

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Traffic News Digest

SUPREME COURT DECISION

Reparation Refund—In a case involving the payment of reparation which was later reopened and the reparation order set aside, the United States Supreme Court has decided that the shipper must refund the reparation that has been paid by the carrier. In the present case the Scott County Milling Company was awarded reparation amounting to $23,944.33 from the Missouri Pacific on account of charges collected on coal shipped from southern Illinois and western Kentucky to destinations in Missouri and Arkansas prior to April 20, 1929. On Nov. 2, 1931 the case was reopened and on July 3, 1933 the commission reversed its previous decision and set aside its reparation order. When the carrier asked the milling company to refund the reparation it refused and the carrier brought suit to recover the amount paid with interest. The Supreme Court of Missouri decided that since the carrier had paid the amount of reparation with full knowledge of the fact without denying liability or waiting to be sued, that the payment was a voluntary one and that on this account the petitioners were not entitled to recover. It further held that the voluntary payment by the carrier caused the respondent to believe that the matter was a closed transaction and that in the circumstances it could not require the respondent to refund.

The Supreme Court in its decision reversing that of the Missouri Court said: "In absence of prior finding by the commission that the tariff charges collected for interstate transportation are unreasonable, there can be no enforceable claim for damages caused by exactions according to the tariff. Prior to the findings and orders of the commission Feb. 11 and Mar. 11, 1929 respondent was not allowed to collect nor was the Missouri Pacific or other carriers allowed to pay the damages claimed by respondent but when the commission made the findings in reparation orders the carriers in the absence of facts constituting a defense were in duty bound to pay in accordance with the order.

Section 16 (1) provides that if the commission shall determine complainant entitled to an award of damages, it shall direct the carrier to pay complainant the sum to which he is found entitled within a specified time. Section 16 (2) declares that if the carrier does not comply within the time limit, complainant may bring suit setting forth the causes for which he claims damages. It also declares that, in claimants' suits in federal courts, the findings and order of the commission shall be prima facie evidence of the facts therein stated. It allows plaintiffs, if they prevail, to recover reasonable attorney's fees. By thus laying on the carriers the burden of bringing forward evidence to overcome presumptions created against them, and by compelling them, if defeated, to pay plaintiffs' attorneys' fees in addition to the interest allowed by law, the act unmistakably evidences purpose directly to prevent interposition of pleas lacking merit and so coercively to bring about prompt payment of the commission's awards.

The facts on which the state court held it would be inequitable to require respondent to refund may be briefly stated. Respondent employed an expert to represent it before the commission and promised to pay him one-half the amount recovered as reparation. Upon collection, it promptly paid as agreed. When petitioners asked refund, more than five years had elapsed and suit to recover back the fee was barred by the statute of limitations. Respondent used the other half to pay dividends and for other corporate purposes. As above indicated, the court held the payment to be voluntary and rested its ruling on that fact. But as shown above it was not voluntary; it was demanded by respondent and compelled by the act, findings, and reparation order. Moreover, equitable considerations may not serve to justify failure of carrier to collect, or retention by shipper of, any part of lawful tariff charges. U. S. Supreme Court in No. 650, L. W. Baldwin and Guy A. Thompson as trustees of the Missouri Pacific Railway Co. petitioners *v.* Scott County Milling Co.

LEGISLATION

Transportation Act 1939—Senate bill 2009 mentioned in the July and previous issues of PIT AND QUARRY has been passed by the Senate and sent to the House. There a sub-committee of the House Committee on interstate and foreign commerce was assigned the task of preparing a transportation bill or of accepting the senate bill. Chairman Lea in announcing the report of the sub-committee states that a new bill has been worked out by his committee which differs from the bill passed by the Senate. If the House bill is passed by the House it will be necessary to have a conference on the two bills to work out the differences. The House bill omits the codification of the interstate commerce act making amendment to the present railroad provisions and motor vehicle provisions and writing a new part providing for regulation of water carriers. The Senate bill had 196 pages and the House bill is reduced to 115 pages. In his report Chairman Lea gave an outline of the bill, some of the high lights of which follow:

The bill declares that it is the national transportation policy of Congress to provide for the fair and impartial regulation of all modes of transportation and to preserve the inherent advantages of each. It is the declared purpose to coordinate and preserve a national transportation system by water, highway and rail, to meet the needs of the commerce of the United States.

The act would unify federal regulation and coordination of the various types of carriers under the jurisdiction of the Interstate Commerce Commission as the regulatory body of interstate transportation.

The bill leaves the Interstate Commerce Commission eleven members as at present. It contains provisions facilitating the reorganization of the Commission in line with the orders recently made by the Commission for that purpose.

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Forwarding carriers are brought within the regulatory provisions of the Commission.

The bill proposes the repeal of existing provisions of the interstate commerce act which require the Commission to take the initiative in drawing and proposing consolidation plans. The act would leave the carriers of various types free to propose consolidations but allow them to be made only with approval of the Commission and upon such conditions as it may find to be consistent with the public interest.

The bill would likewise allow the pooling of traffic and earnings but subject to approval of the Commission. The bill provides for voluntary and not compulsory consolidations; but any plan of one carrier controlling another is unlawful without the approval of the Commission. The existing provisions of the motor carrier act permit consolidations without consent of the Commission where the aggregate number of vehicles involved does not exceed twenty.

Provision is made by which intrastate motor carriers may secure the right to transport interstate shipments within the state, where not substantially competitive with interstate carriers, without a certificate of public convenience and necessity. Such carriers may, with the approval of the state regulatory body, apply to the Interstate Commerce Commission for certificate exempting them from the motor carrier act so that they may engage in such traffic, on the recommendation of the state regulatory authority. Thereupon they may carry on such operations until the Commission has determined whether or not to grant the application.

The object of this provision is to facilitate the distribution of interstate traffic to points where there is no direct interstate motor route.

The bill repeals the declaration of policy in the motor-carrier act and rewrites the declaration, applying it alike to highway, water and rail carriers.

The existing law as to motor transportation by railroads is clarified. The operation of motor vehicles by railroads in terminal areas is subject to the same regulation as the rails. Operation of motor vehicles by railroads outside of terminal areas is subject to the motor carrier act.

Provision is also made to limit the power of the Commission in restricting carriers under grandfather clauses. The bill gives such carrier the right to carry the same commodities and serve the same points as when the grandfather clause became effective.

The present power of the Commission to establish through routes and joint rates is limited to maximum rates where one of the carriers is a water line. A water carrier, not under regulation by the Commission, has no other standing before the Commission at present.

The power of the Commission as to joint rates would include the right to fix both maximum and minimum rates for common carriers by rail and water. The Commission would also have power to fix suitable differentials between water and rail transportation.

The present section against discriminations is amended so as to include regions and districts among the locations against which discriminations are prohibited.

The provisions would authorize an investigation and a correction of rate differentials found to be unjust or discriminatory.

The regulatory provisions as to water carriers are in part III of the bill.

It gives general regulatory authority over interstate water transportation, including intercoastal and coastwise traffic, as well as traffic on the inland waters and on the Great Lakes.

Common carriers by water shall post schedules of rates open to public inspection. Such rates shall not be changed without thirty days' notice except in accordance with the order and regulations of the Commission. The Commission can lessen the notice required, either in special circumstances or by general order.

Contract carriers are required to file and keep open for public inspection schedules of minimum rates. Agreements of contract carriers for transportation shall be filed with the Commission and information concerning the same not made public except as the Commission may order. The Commission is given power to prescribe schedules of minimum rates for contract carriers.

It is provided that bridges over navigable waters for carrying railroad traffic may, by the order of the Secretary of War, be required to be rebuilt so as not to obstruct navigation. A procedure is authorized by which the Secretary of War determines the value of the benefits accruing to the owner of the bridge by the reconstruction. The total cost is then apportioned so that the bridge owner pays to the extent of the benefits accruing to him and the government would pay the balance of the cost. This is a change from the present practice under which the bridge owner is required to pay the total cost, regardless of whether or not any benefits accrue to him by reason of the new construction.

This bill does not attempt to provide any magical remedy for our transportation problems.

Transportation is of fundamental and vital importance to the country, especially so, due to the wide distribution of our productive areas and population.

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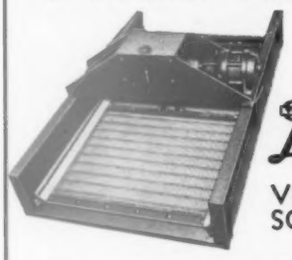

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The American people are now paying about $7,000,000,000 a year for common carrier service, by water, highways and rails. It is a necessary and essential service. Our carriers are in unwarranted distress. Under the present economic situation, we have a surplus of transportation facilities. Even though some such facilities must be discarded, there is no reason why, under a proper comprehensive plan of regulation, our transportation system, though it must and should share the depression with the rest of the country, cannot have a future of better stabilized and sound economic conditions.

This country is necessarily and definitely dependent upon transportation regulation to protect the carriers, shippers and the public alike.

So far, our regulation has not met the competitive situation that has developed during the last twenty years. Effective regulation is not possible without bringing the strong competitors, water, highways and rails, all under unified and coordinated regulatory control. The inequalities of our present rate structure, working injustices as between territories and shippers, and as between carriers, is largely due to the ineffective regulation that now prevails. These inequalities are mainly products of our partial regulation.

It is entirely possible by unified regulatory control of these transportation agencies, the just treatment of each of them, the coordination of rates, and the full utilization of the economic advantages of each class of carriers, assigning to each class the type of transportation for which it is best qualified, the industry can be stabilized and give the country a more assured and better service than it now enjoys.

This legislation is, at least, a decided step toward better regulation on which, to a large degree, the success of our transportation system is dependent.

The passage of this bill and its effective administration will, undoubtedly, make a very substantial contribution to the welfare of our transportation system. Its greatest benefits will not be immediate but dependent upon the more comprehensive and just regulation that it makes possible."

At this time it does not seem likely that any transportation legislation will be passed at this session of Congress. It is probable that the House bill as outlined above will be passed by the House with perhaps some minor changes. This being the case a conference between the House and Senate will probably be held after the adjournment of Congress so that the bill as finally agreed upon by the conferees can be speedily acted upon when Congress reconvenes.

RECENT I.C.C. DECISION

Sand-and-Gravel Routing — Following the general increases in rates in 1937 and 1938 a shipper on the Atlantic coast line asked that that carrier make no increases in the rates on sand and gravel from a local point on the A. C. L. to local destinations on the Clinchfield. This traffic has been moving via the A. C. L. to Columbia, S. C., thence the Newberry to Laurens, S. C., over the C. & W. C. to Spartanburg, S. C., and thence Clinchfield to destination.

The A. C. L. told the shipper it could not comply with his request and accordingly the shipper changed the routing so that the traffic moved via the Southern instead of over the lines mentioned which are part of the A. C. L. family. The A. C. L. accordingly published a new schedule eliminating the Southern in the routing. At the request of the Southern the Commission suspended the schedule and opened an investigation. It found that the A. C. L. could control the routing as far as the Clinchfield was concerned since it was a member of the A. C. L. family, but could not control the routing via the Newberry which was not an A. C. L. line.

The conclusion of the Commission was that the suspended schedules were not justified, without prejudice however to the filing of new ones containing restrictions which would not apply on traffic moving in connection with the Newberry to points on the Clinchfield. I. C. C. I. & S. docket No. 4,520 routing sand and gravel.

EXAMINER'S REPORT

Crushed Stone—Examiner Harold M. Brown recommends that the Commission finds the carload rates on crushed stone from Security, Md., to Gettysburg and Guldens, Pa., unreasonable to the extent they exceeded 70 c. a net ton prior to April 15, 1938, 77 c. thereafter or until the last expiration date. He also recommends reparation amounting to $1,596.51 without interest in I. C. C. docket No. 28,197, North American Cement Corp. *v.* Western Maryland.

NEW COMPLAINT FILED

Cement, Lime and Mortar—The Commission has suspended from July 5 until October 3 schedules published in Supplement 43 to Agent J. R. Shumate's Tariff MF—I. C. C. 121 which proposed to establish a new reduced truckload distance commodity rates on cement, lime and dry building mortar on a minimum of 15,000 lb. from points in Alabama to destinations 160 miles or less in lieu of the present higher class rates. The present rate from Montgomery, Ala., to Birmingham is 34 c. on a minimum of 12,000 lb. The new rate would be 13 c. on a minimum of 15,000 lb. To Carrollton, Ga. the present rate is 41 c. and the proposed rate 14 c. I. C. C. I. & S. docket No. M—762.

OTHER TRAFFIC NEWS

Rule 10 Revision—Hearings on revision of Rule 10 in a classification by the Western Classification Committee were scheduled to begin at Chicago, July 25. The proposal is the same as that for the official classification which was mentioned in the July issue of PIT AND QUARRY.

Commission Reorganization—Effective July 1 the commission began working under its new reorganization plan which reduced the number of divisions from 7 to 5. The divisions abolished were No. 7 which had charge of big rate cases and No. 6 which had charge of water carrier accounting. Heretofore motor carrier rate and finance work had been handled by division 5, which was the motor carrier division. Under the new plan motor carrier rates will be handled by division 2 which also handles rail rates. Members of the commission as it is now reorganized are as follows:

Division 1, administrative, Commissioners Eastman, Porter, and Lee.

Division 2, rates, tariffs, and valuation, Commissioners Aitchison, Splawn, and Caskie.

Division 3, rates, service, and safety, Commissioners Mahaffie, Miller, and Alldredge.

Division 4, finance, Commissioners Porter, Mahaffie, and Miller.

Division 5, motor carriers, Commissioners Lee, Rogers, and Alldredge.

With the recent retirement of J. B. Cooper, manager of Allis-Chalmers Mfg. Co.'s district office at Phoenix, Ariz., the company's former Phoenix office and its El Paso, Tex., branch office will be combined into one district to be known as the El Paso district. O. F. Metz, former branch manager of El Paso only, has been made district manager of the combined new territory with offices at El Paso. H. H. Roth of Phoenix has been transferred to El Paso.

Labor Decisions

Company Union

Hamilton-Brown Shoe Co. v. National Labor Relations Board, etc., decided by the U. S. Circuit Court of Appeals, Eighth Circuit, May 29, 1939; reported at 104 Fed. (2d) 49. This case involved a shoe company's contract with a union of its workers, which the National Labor Relations Board held to be void, upon findings that the company dominated, controlled and supported the union. The court sustains the findings of the board in that respect, holding that "the apparent ease and facility with which the committee [of employees] and [the employer] entered into the contract for a closed shop with [the union], and the omission from the contract of any provision relating to hours, are circumstances which we think reasonably warranted the board in drawing an inference adverse to the company"; also, that the discharge of six members of a union affiliated with the C.I.O. might be further evidence of the company's hostility to that union and its domination of the company union. "Manifestly, an employer may give support and comfort to a particular group of its employees by pursuing a policy of discharging those who refuse to join that group, or who join a rival, obnoxious to the employer."

On a further issue, however, the order of the board is modified. The order of the board would restore the *status quo*. At the time of the unfair labor practice complained of the C.I.O. union would have represented a majority of the employees. However, it appears that before the hearing was closed 90 per cent. of the employees had transferred their affiliation to an affiliate of the A.F. of L. The court holds that in order to restore the *status quo* it is not essential that the employer should be required to recognize the C.I.O. as the agency of the employees for collective bargaining, and that the board should reöpen the question and order an election to determine the issue of representation.

Oklahoma Law

Associated Industries of Oklahoma v. Industrial Welfare Commission, decided by the Supreme Court of Oklahoma, March 21, 1939, rehearing denied April 11, 1939, further rehearing denied May 31, 1939; reported at 90 Pac. (2d) 899. This case was a test of the constitutionality of the Oklahoma Minimum Wage Law, Chap. 52, Session Laws 1937, 40 Oklahoma Statutes Annotated, Sec. 261 *et seq.*, and the validity of orders issued under the asserted authority of that law. After detailed examination of the statute, and comparison with cases upholding similar laws in Washington, Oregon and Minnesota, the Supreme Court holds that the statute is, in general, constitutional; that the regulatory powers delegated to the commission are administrative as distinguished from purely legislative and that the manner in which the administrative power thus delegated is to be exercised does not contravene constitutional inhibitions; and that the law does not violate the "due process" clause of the Federal and state Constitutions.

However, the title to the act referred to "prohibiting the employment of any women workers in any industry within this state at wages which are not adequate for their maintenance." There being no mention in the title of minimum wages for men and minors, the court holds that the act is unconstitutional to the extent that it provides for minimum wages for men and minors. The provisions of the act authorizing the promulgation of orders fixing maximum hours of employment for men are held valid.

As to the administrative orders challenged, the Supreme Court holds that the trial court (the District Court of Oklahoma County) erred in denying the plaintiff's request for a judicial inquiry into the asserted transgressions of its constitutional rights, and directs a reconsideration thereof in the trial court. The orders purporting to establish minimum wages for men necessarily fall because of the invalidity of that portion of the act authorizing the establishment of such wages. The court also points out that the orders are subject to the same test of definiteness and certainty as is a law itself; a legislative act [or an administrative order of a legislative character] which is so vague, indefinite and uncertain that the courts are unable to determine with any degree of certainty what was intended is void.

"Partnerships"

People on the Information of Joseph Shaffer v. Joseph Curiale, decided by the City Magistrates' Court of New York, Borough of Queens, Second District, May 11, 1939; reported at 171 Misc. 265. The defendant was charged with a violation of Sec. 563 of Art. 19 of the Labor Law, which provides employers must keep true and accurate records of hours worked and wages paid to employees. The defendant claimed that he took all employees

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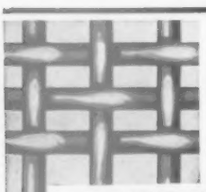

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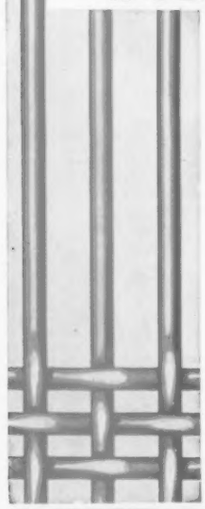

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into separate partnerships with him; but he admitted that the employees, after the signing of the so-called partnership agreement, were receiving exactly the same amounts weekly as before, and that they would share profits but not losses.

"Neither the written agreement nor the actual working conditions," says the court, "could spell out a partnership and this is clearly an attempt to violate the minimum-wage law, also the law requiring workman's compensation insurance. True partnership between an owner and employees calls for mutual responsibility as well as division of profits and losses. The defendant by the preparation of these so-called partnership agreements was in effect making a mockery of the minimum-wage law and it is the barest sort of subterfuge."

Union Activities

Matter of Stork Restaurant, Inc. v. Boland (New York State Labor Relations Board), decided by the New York Supreme Court, Appellate Division, First Department, May 19, 1939; reported at 257 App. Div. 74. The New York State Labor Relations Board found the plaintiff guilty of discharging and refusing to reinstate a number of its employees because of their union activities, and ordered the plaintiff to reinstate such employees, with back pay. The court, however, determines that the finding is against the evidence, and vacates the order. While the findings of the board as to the facts, if supported by evidence, "shall be conclusive," "this means evidence which is substantial, that is, affording a substantial basis of fact from which the fact in issue can be reasonably inferred."

Company Interest

Jefferson Electric Co. v. National Labor Relations Board et al., decided by the U. S. Circuit Court of Appeals, Seventh Circuit, March 31, 1939; reported at 102 Fed. (2d) 949. In this case an employer and an A.F. of L. union contested an order of the National Labor Relations Board which would have prevented the employer from giving effect to a closed-shop contract with the union, from discouraging membership in a rival C.I.O. union, and from encouraging membership in the A.F. of L. union. A review of evidence of the circumstances preceding the signing of the contract with the A.F. of L. union convinces the Court that there was no substantial evidence to support its findings and order.

There were no threats so as to intimidate the employees into joining a particular labor union against their will and no evidence warranting a finding that the conduct of the Company was indicative of coercion or intimidation. The fact that the company [upon request] allowed the use of the cafeteria and other plant privileges to the A.F. of L. union is declared not to be inconsistent with a strict "hands-off" policy. "It was never the intention of Congress to prohibit friendly intercourse between employers and labor unions, to curtail freedom of speech, to deprive an employer of his right to express an honest opinion or to outlaw the extension of common courtesies. It is more in keeping with the purpose of the act to foster such friendship rather than to condemn it."

The board's order also required reinstatement of three employees allegedly discharged because of union activities. The court finds no evidence that the men were discharged because of union activities, and declares that "under the National Labor Relations Act the right to hire and to discharge remains inviolate, when exercised for ordinary ends. The employer may still discharge for good cause or no cause at all."

The board's order, accordingly, is set aside.

Stockholders

Boro Park Sanitary Live Poultry Market, Inc. v. Heller, et al., decided by the New York Court of Appeals, June 2, 1939; reported at 280 N.Y. 481. The essential question settled in this case was whether a dispute between a union and four brothers who were both stockholders and sole employees of an employing corporation constituted a "labor dispute" within the meaning of Sec. 876-a of the New York Civil Practice Act, which regulates the power of the Supreme Court to issue any injunction in any case involving a labor dispute. The court rules that, notwithstanding the unusual circumstances of the case, the legal rule that the corporation is an entity distinct and separate from the persons who compose it must control, and that the dispute was a "labor dispute" within the meaning of the statute.

"Kick-back"

Caivano v. Brill, decided by the Municipal Court of New York, Second District, Borough of Bronx, March 23, 1939; reported at 171 Misc. 298. The plaintiff in this case was hired at an agreed wage of $61.25 a week, but the employment was conditioned on the payment of $25 each week by the plaintiff to his employer. This suit was to recover the amount of such "kick-back" paid during the term of the employment.

The court allows the recovery of such payments on the ground that payments made under a "kick-back" condition in a contract of employment, under economic conditions such as exist to-day, are clearly involuntary payments made under duress and are recoverable. The court rules that an action for money had and received will lie where one has obtained money from another through extortion, coercion or by other means of oppression; that the court may take judicial notice of general business conditions, and that this country is now in an economic depression; and points out that the New York Legislature has recognized the fact that employer and employee do not meet on an equal footing; that the employer in his superior position oftimes conditions the terms of employment to his own best advantage. "We are no longer bound by such unenlightened and archaic concepts of labor relations that we would say that the employer and employee meet as two equals, competent and free to reach their agreement; that either may refuse to give his consent if the terms are not to his liking; and that if a bargain is made, however inequitable it may be and however oppressed one party may be, short of actual physical compulsion, the parties are bound thereby. We realize to-day that employer and employee are not equals; that under present-day economic conditions the employee may be forced to accept terms which he would not accept under normal economic conditions; that the fear of economic distress is a compelling force which, when combined with the superior position of the employer, destroys the free agency of the employee."

TRADE NOTES

The American Manganese Steel Division of the American Brake Shoe & Foundry Co. has expanded its main plant at Chicago Heights, Ill. Six additions and a new administration building were included in this improvement program.

The Patterson Foundry & Machine Co. of East Liverpool, O., has announced a program of plant improvements to be carried out at the East Liverpool plant during the summer. Approximately $50,000 is being spent on new machine tools to be used mostly in the manufacture of the company's line of mixers.

Occupational Diseases and the Law

Silicosis

Bellows v. Merchants Despatch Transportation Co., decided by the New York Supreme Court, Appellate Division, Fourth Department, May 3, 1939; reported at 257 App. Div. 15. In the lower court this case was submitted to the jury upon the theory that it might be found that the plaintiff had contracted silicosis due to the negligence of the defendant. The court charged the jury that if they found that the defendant (employer) had violated Sec. 200 or Sec. 299 of the New York Labor Law, then the defendant was guilty of negligence.

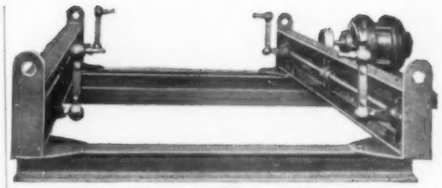
The employer attacked the validity of the cited sections of the Labor Law, which provide in effect that the employer must provide his employees with a safe place in which to work and with adequate tools and appliances (Sec. 200) and require that adequate and sufficient ventilation be maintained (Sec. 299), upon the ground that the terms thereof are too indefinite anl vague to indicte the acts prohibited.

The Appellate Division holds that it can not be claimed that Sec. 200 is indefinite, because it was the common-law duty of the employer to provide a safe place in which to work (*Mautsewich v. U. S. Gypsum Co.,* 217 N. Y. 593, 397); that the provisions of Sec 299 are sufficiently definite to permit its enforcement (*Michalek v. U. S. Gypsum Co.,* 16 Fed. Supp. 708); that a violation of these sections by an employer gives an injured employee a right of action to recover damages (*Schmidt v. Merchants Despatch Transp. Co.,* 270 N. Y. 287); and that the evidence was sufficient to support the finding of the jury that the plaintiff contracted silicosis due to the negligence of the defendant and that the plaintiff was free from contributory negligence.

Trespass

Simon v. Allegheny-Pittsburgh Coal Co., decided by the Court of Common Pleas of Allegheny County, Pennsylvania, January 26, 1939; reported at 34 D. & C. 643. The question for decision in this proceeding was plaintiff's right to maintain an action in trespass, rather than a proceeding under the Pennsylvania Occupational Disease Compensation Act. It is alleged that the plaintiff contracted pneumonoconiosis or silicosis while employed by the defendant as a coal miner, and that the contraction of said disease resulted from the defendant's negligence. June 16, 1936, is given as the final date on which the plaintiff worked. Between that date and January 29, 1938, when the summons in trespass was issued, two great changes in the Workmen's Compensation Act of June 2, 1915, were effected by the legislature, these being the occupational-disease laws of June 4, 1937, and July 2, 1937, which went into effect on January 1, 1938. The defendant contended that the only remedy available to the plaintiff after January 1, 1938, was the filing of his claim under the provisions of those acts.

The court holds, however, that on the date on which the plaintiff quit work he had only a common-law right to sue in trespass for the damages he alleges he sustained. When the 1937 amendments became effective, no status of employer and employee existed from which it could be presumed that the parties agreed to be bound by the remedies under the new legislation; nor was there any obligation on plaintiff's part to notify his former employer that



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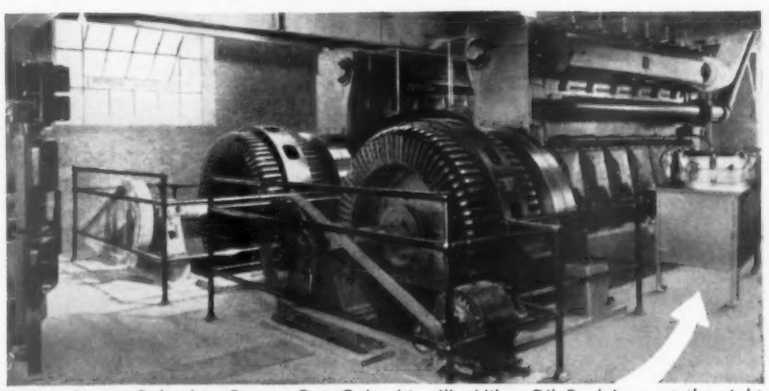

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There's *one* light-weight pipe made to order for your jobs in rough terrain—NAYLOR. Its exclusive Lockseam Spiralweld Structure makes it more flexible than any other. It's easy to handle, quickly assembled, and can be bent cold. Its greater structural strength makes it ideal for pressure service. And remember, light-weight means economy in addition to other Naylor advantages. Sizes 4" to 30" in diameter with all type fittings and connections. Complete fabrication service.

WRITE FOR CATALOG No. 37

NAYLOR PIPE COMPANY
1257 EAST NINETY-SECOND ST.
CHICAGO, ILLINOIS

NAYLOR LOCKSEAM SPIRALWELD PIPE

MEMO

Send next inquiry on perforated metal to

For
PRICE
QUALITY
SERVICE
ACCURACY
Specify
"STANDARD"
SCREENS

ROUND-SQUARE-SLOTS
Accurate Size—Less Blinding
Longer Wear—Less Repair

We can Perforate up to 1" Thick
LARGE STOCK OF RAW MATERIAL FOR QUICK SHIPMENT
Inquiries Promptly Answered

STANDARD STAMPING & PERFORATING CO.
49th Place & Kedzie Ave.
CHICAGO, ILL.

he would not be governed by the 1937 enactments concerning occupational diseases, where the pleadings disclose a complete severance of the relation of employer and employee on June 16, 1936.

Rare Disease

Russo v. Swift & Co., decided by the Supreme Court of Nebraska, June 2, 1939; reported at 286 N. W. 291. This was a suit at common law, seeking to recover for disablement alleged to be due to the employer's negligence. The plaintiff employee was a beef washer, and contracted the rare disease of "echinococcosis." The court holds that negligence is not attributable to the employer, since the disease was so rare that the employer was not to be charged with knowledge of any possible danger to its employees. Such a disease is sharply distinguished from occupational diseases; an occupational disease "must be one which is a natural incident of a particular occupation, and must attach to that occupation a hazard which distinguishes it from the usual run of occupations and is in excess of that attending employment in general."

New Machinery and Supplies

• Crushing Plant

The Universal Crusher Co., Cedar Rapids, Ia., has introduced a new model dual crushing plant in which the belt-conveyor return system for feeding back material from both the primary jaw crusher and the secondary crushing rolls, has been replaced by a new turbine-type revolving elevator called the "Rotavator" which conveys material discharged into it by the under crusher-return conveyor to the screen-feed conveyor directly above the latter.

The saving in weight and overall length and width that results from the use of the Rotavator provide a lighter, more portable unit and actually shortens the cycle, speeding up production.

The Rotavator is made under the Morrissey patents and patents pending which have been assigned to the Universal Crusher Co. and merged with their patent claims. Features of the Morrissey wheel have also been incorporated in the design of the Rotavator.

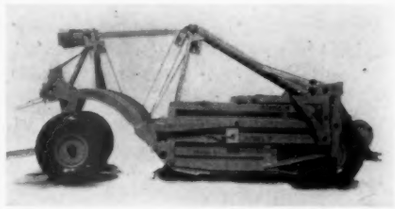
Other equipment of the new Universal Duplex includes a 2½-deck 3 ft. by 8 ft. screen, hopper and grizzly, feeder, sand ejector, streamlined 10-in. by 36 in. lightweight crusher and 30-in. by 18-in. rolls.

The plant is of welded construction, has 12 low pressure tires to meet road regulations and requires only one operator.

• Scraper

Incorporating the features that have made Carryall scrapers so widely accepted plus advances in design and structure, R. G. LeTourneau, Inc. has recently perfected and introduced a new, single bucket scraper, the Model P Carryall.

Built in the popular size—11 cu.yd. struck measure—with an 8 ft. 6 in. cutting blade,



Single-bucket tractor scraper.

the new Carryall can move 15 cu.yd. heaped measure. It weighs only from 18,200 to 18,600 lb. (depending upon the tire equipment), thus giving a high ratio of load to scraper weight and eliminating expensive hauling of unproductive dead weight.

The tailgate sheaves are placed on the sides of the bowl instead of on the top so as to keep them free from dirt, sand, and gravel and to control the tailgate more efficiently

Portable crushing plant using turbine-type revolving elevator.

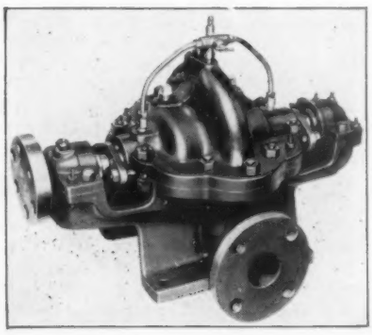
from the center of the load rather than the top. A positive ejector tailgate, cable controlled, gives regulated dumping in any required thickness, and fractional inch control of the cutting blade results in a greater margin of scraper usefulness.

Extra high sides on the scraper bowl retain the extra pay yards that are frequently wasted over the sides with big loads. A new curved yoke strengthens the entire assembly and eliminates stress points.

• Ball-Bearing Pumps

The centrifugal pump division of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., announces the inclusion of ball bearings as standard equipment on nearly all its line of single-stage centrigugal pumps where peripheral speeds are not excessive and where the quality of the pumps are not jeopardized thereby. Since many purchasing engineers still prefer sleeve bearings these bearing housings are designed so that either type of bearing may be accommodated.

The design, selected in close coöperation with leading ball-bearing manufacturers, is a single-row, deep-groove ball bearing on both ends of the pump in cast-iron adapters arranged



Ball-bearing-equipped pump.

for grease lubrication. The designs call for conservative loadings based on carefully computed thrust and radial loads. The single row type of anti-friction bearings have long been successfully used in the company's motors, which have even much heavier loads than ever experienced in centrifugal pumps. However, where specific engineers call for double row ball bearings the design allows that type to be used at but slight extra cost.

Lock nuts used on the shaft at both ends conveniently hold the ball bearings in place without resorting to any press or shrink fits. Their used makes the bearings entirely standard, requiring no special tools or special care in assembling or dismantling, and when needed makes the bearings easily obtainable in local warehouses.

• Wall Finish

"Sparkle Stone Finish," a dry, ready-mixed material for exterior or interior finish is being offered to the trade by Karl Preis, 5048 Blackstone Ave., Chicago, Ill. Formerly of Vienna, Mr. Preis is an expert in the manufacture of artificial stone and asbestos-cement products. The product is said to be weather-proof and acid proof. It is made from Portland cement and natural or artificial aggregates.

"The demand in this country for a decorative construction material such as mine, which can be made in hundreds of beautiful designs and different textures, should arouse the interest of architectural engineers, builders, building material firms, home owners, and promoters of large scale housing developments," Mr. Preis declares.

• Tractor Shovels

The Frank G. Hough Co., Chicago, Ill., makers of road building and materials handling equipment, announces its special-modified International T-35 and TD-35 tractor shovels.

These new shovel models are built around special T-35 and TD-35 Tractors which have

New model tractor shovel.

been modified especially for shovel service. This modification includes special long tracks, six roller-truck frames, spring-loaded foot clutch, double-steering clutches, reverse radiator fan, etc.

Several thousand Hough tractor shovels are in service to-day on wheel and crawler-tractor models handling loose and bulky materials of all kinds, loading trucks and wagons, and handling materials from stock-piles and storage bins.

A POUND OF *THIS* CURE

MANGANAL

Trade Mark Registered U. S. Patent Office

PREVENTS DELAY *HERE*

This shows a Gyratory Crusher Bell with MANGANAL Round Applicator Bars attached ready for filling in with MANGANAL Welding.

MANGANAL Bare and Tite-Kote Electrodes and Applicator (Filler) Bars are recommended for all 11% to 14% steel castings and for armoring any steel surface.

Hard-Surfacing Electrodes — For Overlay Welding

SEACO

Weld Deposit 550-600 Brinell — Work-hardens: Wear-resisting

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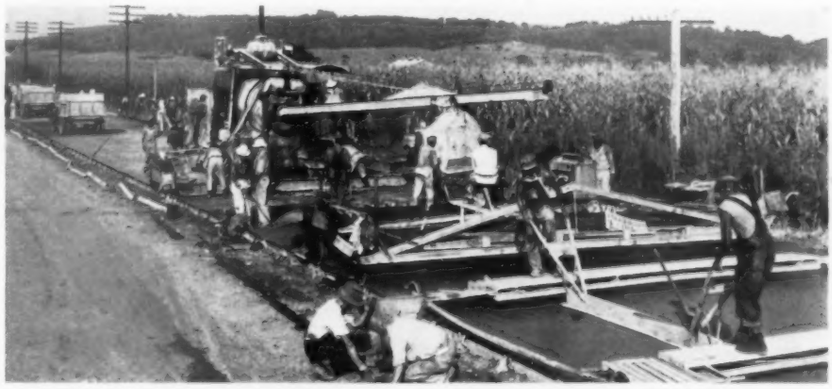
STULZ-SICKLES CO.

Newark — New Jersey



HELPING BUILD AMERICA'S HIGHWAYS

Cincinnati Conveyor Belts

Cincinnati Conveyor Belts are carrying millions of tons of aggregate for road building jobs all over the country . . . are playing a big part in road work, costing millions of dollars.

Why is this? Actual performance records prove that they carry huge quantities of aggregate, efficiently, economically, at a low cost per ton conveyed.

If you must convey sand, gravel, crushed rock, cement or other materials, let us give you the facts about "Cincinnati's" low cost performance.

THE CINCINNATI RUBBER MFG. CO. CINCINNATI, O.

CINCINNATI CONVEYOR and TRANSMISSION BELTS
HOSE · CHUTE LINING · SUCTION HOSE

• Fuse Lighter

A recent development in improved blasting technique is announced by the Ensign-Bickford Co., Simsbury, Conn., in its Master fuse-lighter, consisting of a tough, waterproofed fiber cartridge shell in the base of which is an ignition compound. The shell is topped with a rubber cap, the center of which is so designed that when the fuse is pressed against the thin portion, it is easily punctured, allowing the fuse to be seated against the ignition compound. It serves also to hold the fuse in place.

Each lighter is said to hold seven fuses, six that lead to charges in the bore holes; the seventh is a pilot fuse. The manufacturer recommends this fuse lighter particularly for use in mines where rotation firing is used. Holes are loaded in the usual manner with the fuse extended far enough so as to form groups of two to six holes with each Master lighter. This fuse is then trimmed for proper rotation of shots. When more than one Master lighter is used at a face, the pilot fuse in each is trimmed for proper rotation of lighters. It is claimed that this device permits greater safety and efficiency.

In wet work the lighter can be turned up so as to prevent dripping water from running down the fuse or wetting the powder in the end of the fuse.

• Screen Cloth

A new type of screen cloth has been introduced recently by The Jeffrey Manufacturing Co., Columbus, O. This new product is made of piano wire and is unusual in that the wires run in one direction only with no cross wires.

This screen cloth is stretched to such a high tension that the individual wires develop a resonance having the peculiar property of passing undersize particles much more rapidly than the conventional types of cloth. In addition, the manufacturer claims that this piano wire has much greater capacity and longer life, with almost complete freedom from blinding.

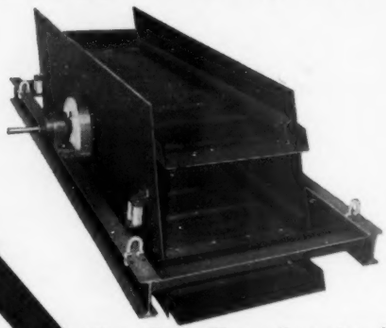
Due to the great tension placed on the wires it is necessary that the screen sash holding them be especially constructed. At present this cloth is made in meshes from ⅜ in. to 120 mesh, and can be furnished in stainless steel if desired.

Piano-wire cloth applied to an electric-vibrating screen.

Buys Philadelphia Property

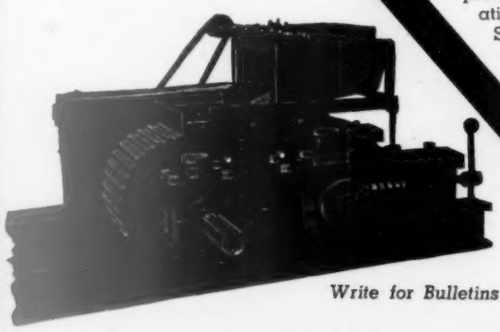
Jos. T. Ryerson & Son, Inc. has purchased its Philadelphia plant property at 5200 Grays Ave. from the Taylor-Wharton Iron & Steel Co. The property had formerly been under lease.

NEW HOLLAND Vibrating Screens



Roll Crusher with new Pulsating Feeder gives extra high capacity in reduction of 3" material down to sand fineness. Full range of sizes up to 100 tons per hour.

New, Circle Throw Screening Action insures a *better* deal in grading—sets the high marks in capacity, uniformity of product and thrifty operation. Heavy Duty Screen built in six sizes, one to three decks.



Write for Bulletins

NEW HOLLAND MACHINE CO., New Holland, Pa.

Trade Literature

The New Trend in Quarry Haulage. 4 p. (Bulletin 138.) Easton Car & Const. Co., Easton, Pa.

Hough Hydraulic Tractor Shovels. 4 p. (Bulletin 114.) Frank G. Hough Co., Chicago, Ill.

Swing Hammer Crushers and Pulverizers. 32 p. (Bulletin No. 710.) Jeffrey Mfg. Co., Columbus, O.

The Telsmith Gyrasphere. 16 p. (Crusher Bulletin 263-E.) Smith Engineering Wks., Milwaukee, Wis.

Amsco Manganese Steel. 62 p. (Catalog No. 59.) American Manganese Steel Co., Chicago Heights, Ill.

Morse Flexible Couplings. 32 p. (Bulletin 57.) Morse Chain Co., Ithaca, N. Y.

Thur-Ma-Lox . . . High Heat-Resisting Coatings for Protection of Steel. 4 p. M. W. Kellogg Co., Jersey City, N. J.

Vibrating Screens, 8 p. *Hammer Crusher No. 24B,* 4 p. *Plate Pulverizer with Closed Door,* 8 p. New Holland Machine Co., New Holland, Pa.

HarriSteel Abrasion Resisting Woven Wire Screen Cloth. 4 p. HarriSteel Products Co., New York, N. Y.

Diesel D7 Tractor. 32 p. Caterpillar Tractor Co., Peoria, Ill.

Dust Control. 8 p. (Bulletin 1481.) Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Day Pulverizers. 8 p. (Bulletin 999.) Brooks Equipt. & Mfg. Co., Knoxville, Tenn.

Power Transmission Equipment. 272 p. (Catalog No. 600.) Link-Belt Co., Chicago, Ill.

Hayward E-16 Rehandling Buckets. 8 p. Hayward Co., New York, N. Y.

Ball Mills. 24 p. (Bulletin 1813F.) Allis-Chalmers Mfg. Co., Milwaukee, Wis.

INCORPORATIONS

Lain Gravel Co., Cleburne, Tex. Capital: $15,000. Incorporators: J. Lambert Lain, Lorena Lain, J. E. Lain.

Concrete Brick & Stone Co., Sioux City, Ia. Capital: $25,000. Incorporators: F. K. Lytle, B. S. Peete, R. W. Pitner.

Pembroke Marble Co., Roanoke, Va. Capital: $50,000. W. J. Raike, Roanoke, president.

Concrete Products Co., Daytona Beach, Fla. Capital: 50 shares n.p.v. Incorporators: T. J. Snead, L. G. Snead, E. M. Snead.

Grimes Mill Quarry & Rock Co., Lexington, Ky. Incorporators: H. H. Given, Louise Given, Marjorie Spencer.

Burgandy Hills Quarries Corp., Boston, Mass. Capital: 2,000 shares n.p.v. Incorporators: Bruce Cramer, Guy Healey and Randolph Weber.

Announcement has been made by the Quaker City Rubber Co., Philadelphia, Pa., of a new branch opened at Houston, Tex.

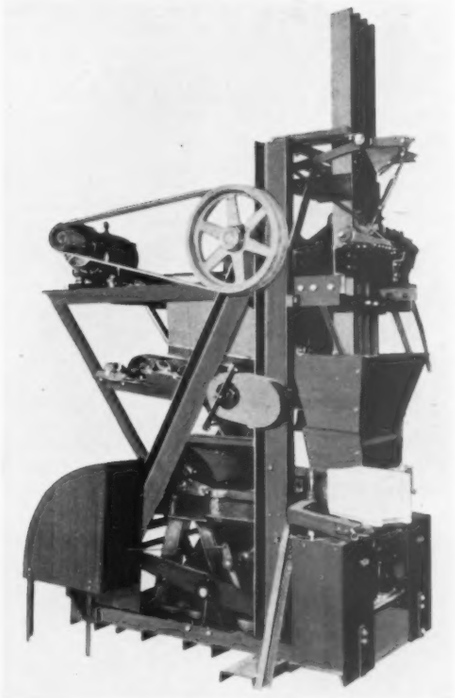
The Houston branch in charge of H. M. Sossaman, will serve Arkansas, Louisiana, Mississippi, New Mexico, Oklahoma and Texas.

The CONCRETE MANUFACTURER

A Special Section of ...

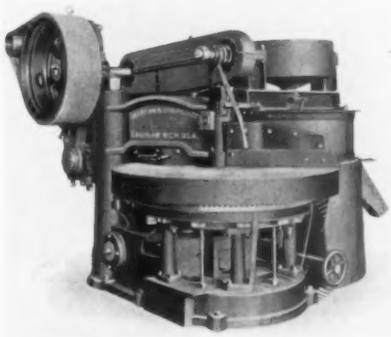
J. & C. CONCRETE MACHINERY

Automatic Stripper Block Machine



This concrete block machine is unequalled for its smooth and steady production. Will make all required sizes and shapes demanded in the concrete industry. Will handle any type of aggregate and make up to six blocks a minute, with very little maintenance cost. Built with the same high standard of quality as other Jackson & Church machinery. Write today for further details and prices.

Concrete Brick can now be made on the famous JACKSON & CHURCH Brick Machines



After leading the field in the Sand Lime Brick Industry for over thirty years, the Jackson & Church brick presses have again proven their superiority over other brick machinery in the manufacture of concrete brick. Capacities up to 3300 brick an hour may be had. Brick are high in strength and low in absorption. *No pallets are used,* as the brick are piled on top of each other on flat deck cars or racks. Will make cinder, slag or concrete brick equally well. Our engineering department will be glad to furnish you with details and prices on installation of these outstanding machines. Write today.

Watch next month's ad featuring our VIBR-RITE Plain Pallet Concrete Block Machine

Since 1881

JACKSON & CHURCH CO.

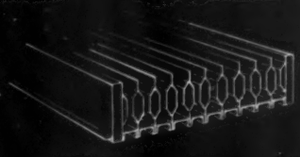
Saginaw, Mich.

Complete Line of Concrete Equipment

VIBRATION and TAMP BLOCK MACHINES

MIXERS

BRICK MACHINES



CONCRETE JOIST MACHINES

MATERIAL HANDLING EQUIPMENT

The CONCRETE MANUFACTURER

August, 1939

A SPECIAL SECTION OF PIT AND QUARRY DEVOTED TO PRODUCTION MARKETING AND USES OF CONCRETE PRODUCTS AND READY-MIXED CONCRETE

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Establish Fellowship

The Cemenstone Corp. of Pittsburgh has established an industrial fellowship in Mellon Institute for conducting fundamental chemical and physical research on precast concrete units such as are being produced by new principles of manufacture by the donor company.

Donald R. MacPherson has been appointed to the incumbency of this fellowship. A graduate of the chemical engineering department of the University of Washington, for the past ten years he has been engaged in various branches of portland cement and concrete technology. He first spent three years as concrete specialist with the engineering department of the city of Seattle, where he became familiar with methods of design in the practical use of concrete. This experience was followed by two years of investigation of various highway materials for the highway department of the State of Washington. Later, throughout the past five years, he was a member of the research staff of the Portland Cement Assn. in Chicago, devoting particular attention to problems of cement chemistry and manufacture.

■

In Block Business

Dredging equipment owned by the Soo Sand & Gravel Co., Sault Ste. Marie, Mich., is engaged in channel-deepening work for the Huron Portland Cement Co., at Alpena, Mich., and the Thunder Bay Quarries Co.

The Soo concern has also just installed a Besser power stripper for the manufacture of concrete blocks at its Sault Ste. Marie plant. First utilization of the output was in the construction of a plant office building 24 ft. by 28 ft. in size.

■

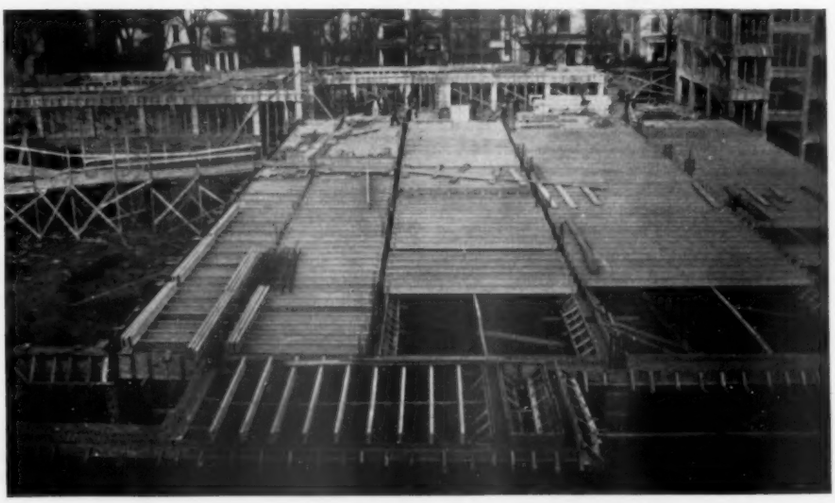
New Ready-Mixed Plant

A new ready-mixed-concrete plant is being erected on the old James N. Dugan gravel-pit property on the outskirts of Covington, Ky., by S. E. Willey, Inc.

Recent Equipment Installations ★ ★ ★

A Besser vibrator block machine has just been installed at the plant of the Omaha Concrete Stone Co., Omaha, Neb. . . . *Ford V-8 gasoline engines have been placed in service to supply power at a new plant operated by the Harris-McBurney Co. near Jackson, Mich.* . . . Three new truck mixers and Butler bins and batching equipment have been added at the ready-mixed-concrete operations of Ray Sablain, Lansing, Mich.

Stearns Joltcrete machines are new production equipment at the Ideal Cement Stone Co., Omaha, Neb.; Cinder Block Co., Roanoke, Va.; and V. Paturzo Bro. & Son, Baltimore, Md., while the Amiss Block Plant, Lansing, Mich., and E. Felicetti & Sons, Niagara Falls, N. Y., have installed new Stearns Clippers . . . *Dieterman Bros. of Kalamazoo, Mich., are now operating with a Besser mixer and a Besser block machine is new equipment this year at the Edgerton Sand & Gravel Co., Edgerton, Wis.*



Nearly 20 miles of concrete joists were used in the construction of the new Men's Dormitory building on the campus of the University of Michigan at Ann Arbor, Mich. An early construction view, with some of the first joists in position, is shown above. They were produced on a Lith-I-Bar machine, made by the Precast Unit Co. of Kalamazoo, Mich.

By A. LOCKHART
Manager, Cleghorn Corp.

An aërial view of the Cleghorn Corp. operations at Longwoods, Md. Dredge and gravel plant at left, concrete-block plant at right.

Block Manufacture Profitably Solves This Producers Surplus-Sand Problem

IN common with many other producers of washed gravel the Cleghorn Corp. of Longwoods, Md., was faced a year and a half ago with the problem of surplus sand. Located on the eastern shore of the state, where there has been a building boom in country houses as well as considerable local construction requiring good building material, this company had no trouble selling stone, but the sand pile was gradually increasing. The manufacture of concrete blocks offered an outlet.

Investigation showed that most of the local blocks were made either from beach sand with little or no coarse aggregate, or from bank-run gravel with a variable percentage of clay and other impurities. The possibilities of a first-class block, made from washed aggregates in the proper sizes and proportions, were apparent immediately. After thorough study, including the inspection of other plants, getting information through the Portland Cement Assn. offices, and being guided by the *Recommended Practice for the Manufacture of Concrete Block* as published by the American Concrete Institute, the block plant was laid out. The straight-line production principle was followed from the sand screen to the storage yard.

A temporary frame shed was placed at a convenient distance from the gravel and sand bins so that sand could be sent directly to the shed in an alternate trough which could be shut off when sufficient aggregate was on hand. At the same time a ⅜-in. screen was added to the rotary screen to provide the coarse aggregate. Curing rooms of gravel-block construction were added with a capacity for curing a maximum day's production of 1,000 blocks with steam and heat. The cement floors in the shed and curing rooms were graded to the paths in the stock-yard so that lift trucks could be easily moved. A roof was erected next the mixer end of the shed to cover three days' supply of sand in wet weather, and wood ramps were extended over the sand piles graded to the mixer level so that aggregate could be moved to the mixer on rubber-tired wheelbarrows.

The original equipment consisted of a portable mixer and a Miles No. 1 down-face block machine. However, as business increased after the sale of the first blocks in January, 1938, a Blystone 9-cu. ft. mixer, Miles below-floor elevator and feeder finishing attachment and overhead power tamper were added, all driven by a line-shaft belted to a 10-hp. electric motor. A Barrett lift truck and wood racks are used for transporting the blocks.

The methods of manufacture and curing have been as important a factor in the success of the enterprise as the equipment—having loaded wheelbarrows next the mixer ready to dump (providing the maximum mixing time), measuring the aggregate and cement and proportioning them to give the most strength, measuring the mixing water, adding 2 per cent. Dowflake calcium chloride, timing the tamping period, and curing with steam and heat for a 24-hr. minimum, followed by wet curing for five days in the stock-piles.

For measuring and applying the mixing water a gravity tank with a marked glass gage has been installed over the mixer discharging evenly over the mix

A view of the block plant with sand-and-gravel processing equipment in background.

through a pipe pierced with holes on the under side. This tank is filled to the desired level and when the mix is ready the valve is opened, allowing the mixer operator additional time for filling wheelbarrows for the next mix. The addition of the calcium chloride reduces the breakage in handling, helps to prevent freezing, and retains the moisture necessary for proper curing. The steam curing makes it possible to fill rush orders of special sizes, insures proper curing, and reduces the breakage or chipping in handling green block.

The selling methods are simple but satisfactory. Only enough advertising is done to keep the company's name before the public, and 90 per cent. of the blocks are sold through building-supply houses. This arrangement has been mutually beneficial. The firm did not have to work up sales, and the supply houses were more than satisfied with a high-strength block at the same price they had been paying for other block. The volume of business gradually increased to the point where it has been found advisable to increase stock-yard capacity to 50,000 blocks.

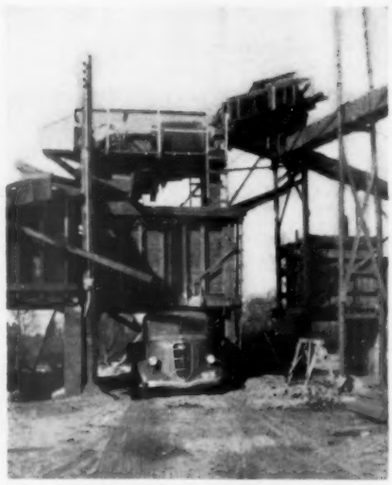
Most of the early sales resistance was due to the fact that the market had been supplied to some extent with inferior blocks, made from unwashed aggregate or with insufficient cement. The quality of the blocks has "sold" them in most instances, and the value of precise manufacturing methods has been apparent in the compressive strength on test which has been more than enough to meet city building-code requirements.

Production is ordinarily limited to from 500 to 600 units a day. Three men, operating the mixer and the machine, moving blocks to the curing rooms, and from the curing rooms to the stock-piles and loading trucks, attain this production. They are paid a bonus for blocks made over a stipulated number. A maximum production of 1,000 a day is attained by the addition of two men. This wage system provides an incentive, and has worked satisfactorily as well as maintaining the labor cost per block at a fixed level.

Power tamper and mixing equipment on the block-plant floor.

Production was increased when this dredge replaced a drag-line scraper.

In summary, the manufacture of blocks, which was started as a side-line and as an outlet for sand, has developed a volume of business equal to that of the gravel-washing plant. In spite of limited production during the first months, and after a fire which destroyed the original frame shed, over 80,000 units have been made and sold during the past year's operation. Of these, 10,000 were cinder blocks made on order and 3,000 were 8-in. by 12-in. by 16-in. gravel units. The rest were 8-in. by 8-in. by 16-in. plain, rock-face and panel-face.

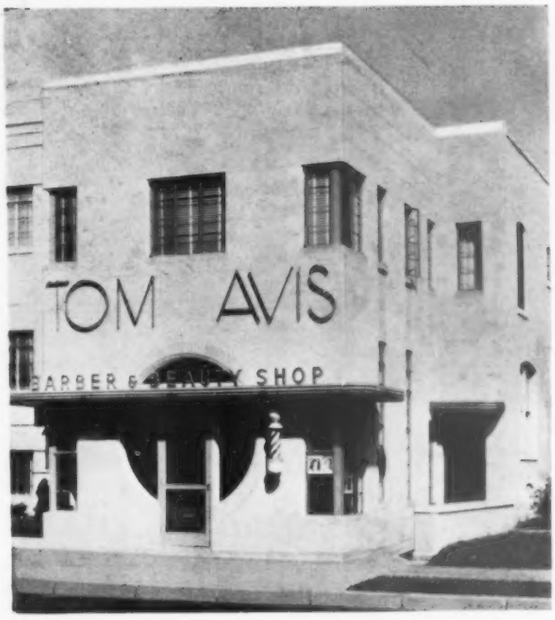


Truck being loaded at the gravel plant.

The gravel-washing plant, however, after the addition of new equipment, is now in a position to supply an increased local market. A 9-cu. ft. Crescent drag-line scraper was used at first, but was found unsatisfactory for handling wet material. With sufficient water supply a dredge was decided on. A 6-in. Morris pump, driven by a 90-hp. LeRoi engine, recently purchased and mounted on a scow, give much greater production than was possible under former conditions. Two additional overhead bins were also erected, providing a total overhead capacity of 200 tons of stone and plastering sand.

The gravel is pumped 35 ft. high for discharge over a flat ¼-in. screen feeding two sand troughs, one to the block plant and the other to the stock-pile. The plus ¼-in. sizes and what minus ¼-in. does not pass through the flat screen are graded by an Iowa Mfg. Co. revolving screen into the following sizes: smaller than ⅛-in.; ⅛-in. to ¼-in.; ¼-in. to ⅜-in.; ⅜-in. to ¾-in.; ¾-in. to 1½-in.; and oversize. This aggregate is dropped into an overhead bin underneath the rotary screen with the exception of the 0-in. to ⅛-in. plastering sand, which is further washed and moved by means of a screw-conveyor to an adjacent bin. Another bin next to this one is charged by a belt-conveyor carrying ¾-in. stone from the rotary screen. The drag-line scraper is now used to stock sand in a high pile after it has backed up to the level of the trough.

Prospects for the coming season are good as the purchasing public realizes the value of washed aggregate in the making of concrete, and it has been the experience of this company that the contacts made in the selling of concrete blocks have been advantageous in selling washed gravel and *vice versa*.



This barber and beauty shop in South Bend, Ind., built with Waylite blocks, is an excellent example of a small commercial building done in the modern manner. Pleasing to look at and inviting to patrons, the structure is fireproof, strong and rigid as well.

Blocks from the Concrete Products Corp. plant are being used in erecting the small restaurant building shown above. Because of the rounded corners on the structure and other intricacies of design demanded by the builder, Mr. Bohm had to produce 20 different "specials" for this job. A corner detail is shown at the right. Note the lettered guide tabs pasted on the units.

A concrete-block addition is being erected at the Concrete Products Corp. plant this summer, a construction view being shown at the left. Below is another Waylite block job recently completed for the Main Electric Co. of South Bend. Office, retail salesroom and the shop are on the main floor, living quarters above.

ATTRACTIVE BUILDINGS PROMOTE SALES

MANY of the concrete-products operators in the middle west know Paul E. Bohm, head of the Concrete Products Corp. of South Bend, Ind., and are familiar with the success he has attained in his field of endeavor. Through careful attention to production, the use of modern equipment and plant facilities, forceful salesmanship, and because of his wide acquaintance with architects and builders, Mr. Bohm continues to dominate the South Bend market. He has sold concrete-masonry units, plus concrete floor joists, for an ever-increasing number of outstanding buildings. He has convinced many builders that concrete block is the modern building material, that it is adapted to any style of architecture. Some of the accompanying pictures of representative business structures built in South Bend recently are proof that exposed concrete blocks —without stucco, brick veneer or other surface treatment—can be pleasing in appearance as well as possessing all their other well-known advantages of strength, fire resistance and moderate cost.

A little more than a year ago the writer visited the plant of the Concrete Products Corp. and prepared a brief article describing it (*P&Q*, May, 1938, pp. 66-67). When he returned a few weeks ago for a chat with Mr. Bohm he was astonished to note

Two signboards like this advertise and direct the prospect to the plant.

the numerous changes and improvements which had taken place. These included:

(1) Two new undercover storage structures.

(2) A complete new system of concrete runways.

(3) A new Stearns 28-cu-ft. mixer.

(4) A new inclined conveyor for gravel.

(5) A new curing room exclusively for concrete joists.

(6) A concrete-block plant addition (under construction).

(7) White Showers-Detroit fog nozzles in use in the curing tunnels.

One of the covered storage yards. Another is visible in the background.

Last year the company was manufacturing gravel, Waylite and cinder blocks, with the last-named in the best demand. Now the swing in popularity is definitely toward Waylite units,

Wide, smooth concrete runways such as this one along the curing-room doors are found throughout the plant property.

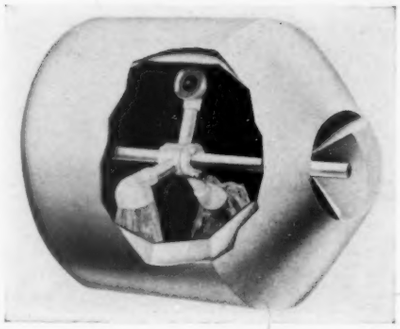
Mr. Bohm reports, due in large measure to the fact that this type of unit has been awarded the highest rating as a fire retardant by the underwriters—4 hours. Other concrete units made with natural and manufactured aggregates have 3-hr. ratings.

The main production machine for blocks is a Stearns power stripper, two older tampers also being used at times. Joists are made on an R&L vibrating table. The new Stearns mixer replaces an old Ideal machine. A gravel deposit adjoins the plant, the material being excavated by a drag-scraper and carried to the mixing floor of the plant by the new conveyor mentioned previously. Cinders and Waylite are received by railroad from Chicago.

• Water Impeller

The Blaw-Knox Co., Pittsburgh, Pa., reports the development of a new style water impeller for its line of Trukmixers. The improved impeller, shown in the accompanying illustration, is attached to the water line at approximately the center of the drum. There are three outlets, each of which terminates in a nozzle that is protected against the action of the aggregates, and sealed against intrusion of mortar and cement. These features were proved in actual field service, and examination after six months' constant use revealed no clogging or accumulation of material inside the nozzle.

Fast water is important on short hauls, or where mixing is not allowed until the truck mixer arrives at the job. With these considerations in mind, the impeller has been designed to provide fast flow and rapid distribution of water uniformly throughout the batch. The radial distance between the axis of the water pipe and the nozzle discharge opening materially increases the pressure head. Moreover, the discharge openings, being at right angles to the axes of rotation, create a suction due to the relative motion between nozzles and concrete; this is accomplished without the use of a pump. Finally, the use of three outlets spaced 120 deg. apart insures greater continuity of water flow since two of the outlets are discharging at all times.



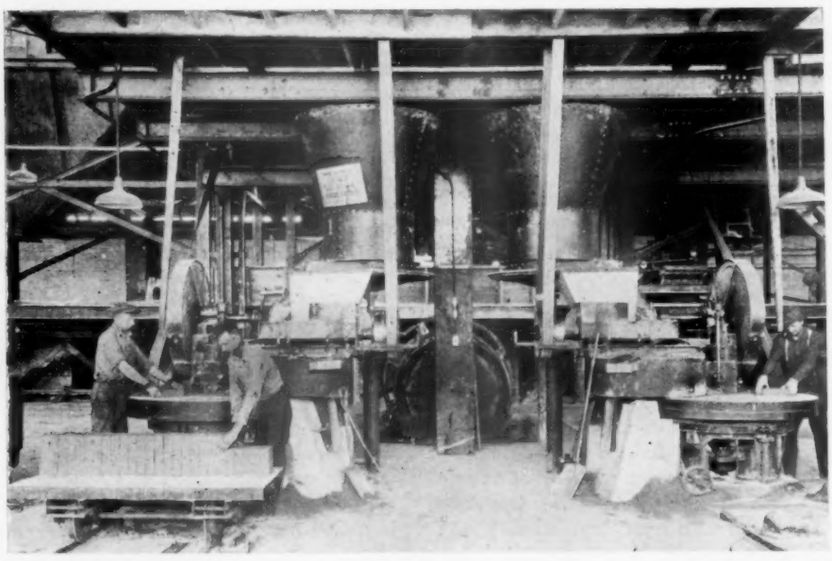
Cut-away view of the new style water impeller.

Removal of one bolt permits complete dismantling of the nozzle mechanism for inspection and cleaning.

• Brick Machine

For more than 30 years Jackson & Church brick presses have been used for the manufacture of sand-lime brick. In recent years several sand-lime-brick producers have experimented with concrete aggregates and found that a highly satisfactory concrete brick could be made, at low cost, with this machine. The bricks are clean cut with sharp edges and accurate in size. They possess a high compressive strength as well as a low absorption factor. No pallets are necessary as the brick are piled on top of each other on flat-deck cars or racks. Capacities with the Jackson & Church machine run up to 3,300 brick per hour, believed to be the highest machine production attained for concrete brick.

Cinder, slag or gravel brick can be made without any change-over of parts. With concrete brick becoming more and more popular, the Jackson & Church Co. has decided to adapt its machines to the manufacture of concrete brick and has also added a complete line of concrete machinery such as mixers, block machines both of the tamp and vibration types, joist-making equipment and material-handling equipment of all kinds. Its engineering staff is constantly working on these improvements. Complete engineering service is available in plant layout and equipment selection. The Jackson & Church Co. is located at Saginaw, Mich.



Workmen removing concrete brick from presses and stacking them, without pallets, on cars for removal to curing kilns.

LEFT—The office and yard of the O'Neal Block & Septic Tank Co. BELOW—The new machine which has produced 4,468 blocks in one day.

Operates Miami Block Plant at Profit Despite 8½-Cent Price

IN recent years much publicity has been given to the truism that competition is the life of trade. It is also widely held that intensive competition, with its accompanying low price levels, forces producers to adopt the most efficient and economical methods and equipment in order to survive. Be that as it may, such conditions certainly make life interesting for a producer.

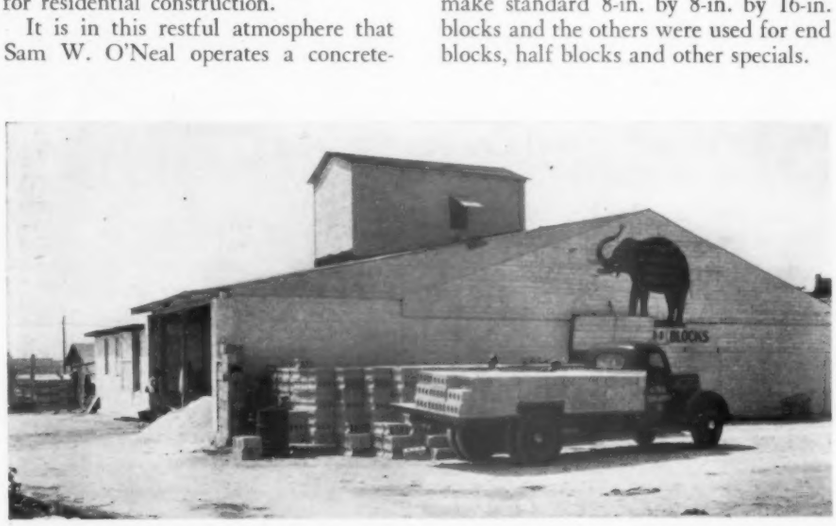
Miami, Fla., is a hot-bed of competition for all types of building materials, including concrete products, and concrete blocks are being sold there year in and year out for a lower price than anywhere else in the country, unless the writer is badly mistaken. Standard concrete blocks are sold for 8½ c. each, delivered anywhere in the Greater Miami area, which includes Miami, Miami Beach, Coral Gables, Cocoanut Grove and many other rapidly-growing communities within 25 to 30 mi. of Miami. There are at least eight concrete-block manufacturers with plants in this area, which in 1938 used over 10,000,000 blocks. Most of these blocks are used for residential construction.

It is in this restful atmosphere that Sam W. O'Neal operates a concrete-block plant and, he says, operates it at a profit. With labor at 35 c. per hr., and sand and rock screenings at $1.25 per ton it is evident that his must be an efficient operation. Mr. O'Neal sold all the blocks he could make in 1938 and, from present indications, expects this year to be one of the biggest in his history. The quality of his product is evident from the fact that an average strength of 1,100 p.s.i. is obtained, far in excess of specifications. Nineteen standard blocks are made from each sack of cement.

Mr. O'Neal founded the O'Neal Block & Septic Tank Co. in 1924 in the present location at 29th St. and 13th Ave. in Miami. The original equipment consisted of four Anchor stripper block machines with power tampers and hand lifts. These machines were operated on a piece-work basis and produced an average of 200 blocks per hr. each. Because of the lack of space and mixer capacity, however, it was only possible to operate two machines at a time. Two machines were equipped to make standard 8-in. by 8-in. by 16-in. blocks and the others were used for end blocks, half blocks and other specials.

In July, 1938, these machines were replaced by a No. 9 Stearns Joltcrete complete with skip and mixer. This machine makes either three standard blocks, two 8-in. by 12-in. by 16-in. blocks, or six 4-in. by 8-in. by 16-in. partition blocks at one time.

By removing either or both of the end cores single-corner and double-corner blocks can be made. The change-over from one type to another, which



The block plant with truck being loaded in the foreground.

Dumping aggregates into skip bucket for the mixer above.

also includes changing the pressure head, takes only 5 min. The bottom pallet grooves the blocks and the ends are slightly beveled with finger holds.

The maker guaranteed this machine to produce 9 standard blocks per min. but this rate is being exceeded for a full day's run. According to A. F. Miner, superintendent, 4,256 standard blocks have been produced in 7 hr. and 4,468 have been made in an 8½-hr. day. This is done with three men on the mixer, two on the machine and one hauling the blocks away. Mr. Miner says that with a larger mixer only two men would be required on that end and even greater capacity could be obtained. Four or five men are kept busy hauling blocks to outdoor storage and loading them into trucks for shipment. A 5-ton Mack truck is kept busy from 6:30 a. m. to 9:00 p. m. hauling sand and rock from the Seminole Rock Co., making a round trip every 25 to 30 min.

The skip bucket dumping ingredients into the 18-cu.ft. mixer.

Lime-rock screenings and sand are discharged from trucks into piles at the plant. These aggregates are loaded with hand shovels into wheel-barrows of special scoop shape designed by Mr. Miner. The aggregates are dumped into the 21-cu. ft. skip bucket where cement is added from sacks. The bucket discharges these ingredients into the 18-cu. ft. Stearns mixer from which the concrete is discharged into a hopper over the block machine.

The blocks are transferred from the machine to steel racks, each holding 48 blocks. The company has over a hundred of these racks which makes it possible to leave the blocks on their pallets on the rack for 24 hr. before they are removed to outdoor storage piles. The blocks are sprayed both when indoors and outdoors.

The company also makes concrete septic tanks. These are made in the yard with steel forms and a job mixer. A special hoist truck is used to handle and deliver these tanks. The company also owns five trucks which are used for delivering the blocks.

Cinder-Block Makers Meet at Atlantic City

The annual convention of the National Cinder Concrete Products Assn. is being held July 31, Aug. 1 and 2 at Atlantic City, N. J. General arrangements were made by Harry H. Longenecker, Penn Building Block Co., Philadelphia, Pa., secretary-treasurer of the organization.

Opens Products Plant at Cambridge, Md.

The Cambridge Concrete Products Co. opened a plant at Cambridge, Md., in June for the production of gravel and cinder blocks. J. Ridgway formerly of Pottstown, Pa., is superintendent, H. Lockhart being manager and purchasing agent.

Equipment includes an Anchor stripper and a 9-cu. ft. Blystone mixer. Crushed cinders are delivered by water from Baltimore and sand and gravel are supplied by the Cleghorn Corp., Longwoods, Md.

Exemption Hearing at Washington, August 7

A hearing on the application of the concrete-products and clay-products industries for exemption from the maximum hours provisions of the Fair Labor Standards Act because of the seasonal character of the industries is scheduled to be held August 7 at Washington, D. C., Administrator Elmer F. Andrews has announced.

Those interested in opposing or supporting the application must file notice of intention of appearing with the Administrator not later than noon, Thursday, August 3.

Dry-Batched Concrete Delivered in Boxes

Truck trailers have been carrying dry batched materials from the plant of the Cass City Sand & Gravel Co., Cass City, Mich., this summer to concrete paving projects on the state highway system in that vicinity.

Four or five batch boxes are usually carried on a load to the mixer. Each box contains approximately 3,700 lb. of sand and gravel and 6 sacks of cement. As many as 400 boxes have been hauled daily. All materials are inspected at the plant by an engineer of the Michigan State Highway Department.

Dust Collectors Big Health Aid, Survey Reveals

"Why did you install dust collectors?" was one of the questions asked by Sales Manager Fred A. Ebeling of The W. W. Sly Mfg. Co. of Cleveland, O., in a letter written to some prominent firms in various industries.

While many good reasons were given, it is noteworthy that back of all of them in general was the desire of the management to provide healthful working conditions as expressed in the following excerpts from typical replies:

" . . . our installations have been made from the standpoint of improving safety and health conditions in our plants, and any information which I may give you will be more or less general, therefore without much data on the economic angle."

" . . . dust nuisance was the first consideration in making these installations and we are very well satisfied with the result."

"We might say that it would be very difficult to estimate the economic returns of our dust collecting installations. These returns are intangible, although we do feel that they are there."

"Our decision to install collectors at our various plants was brought about more by the desire to clean up the plants and improve conditions in general, and I might say that wherever we have made installations we have accomplished all that we set out to do. All our plant superintendents are very well satisfied with their installations and, as you know, we are again installing a number of collectors this winter which should be pretty good evidence that we thoroughly believe in them. General cleanliness around the plant and goodwill from the employees is, of course, an economic advantage, but it is hard to measure in dollars and cents. Only in one case were we requested by the authorities to install a collector—all the other installations are being made on our own initiative."

"We have recognized the value of dust control from the standpoint of housekeeping and better relations with the workers employed in these departments. We have found that, when the workers recognize the desire of the management to provide them with clean, healthy working areas, they immediately show a greater interest in their work, and in maintaining the premises clean and the equipment in working order."

FHA Aids Nationwide Modernization Program with Promotional Material

CONCRETE-PRODUCTS manufacturers will benefit from a nation-wide campaign to promote property modernization and repair, which is an important item on the building industry's summer schedule.

The campaign has the full coöperation of the Federal Housing Administration and "broke" simultaneously in all sections of the country early in June. The theme is "Fix Up Your Home! Modernize Outside and Inside," and convenient monthly payments on the FHA Plan of installment buying will be featured.

During the past few years the building industry has found that many modernization jobs can be closed and new prospects developed by featuring these Property Improvement Loans (FHA Title I Loans). Furthermore, the FHA Plan means cash payment to the dealer.

Because of this, members of the industry will take a special interest in figures recently released by the Federal Housing Administration. These show that even during the normally dull winter period, private lending institutions continued to make Property Improvement Loans, and that more inquiries and applications for these loans are being received right now than at any time since the FHA Plan was put in operation. Modernization loans insured by FHA during the last week of April amounted to $4,500,000, or more than 9,000 loans per week.

This increased activity indicates that the public and the lending institutions are coming to realize and avail themselves of the benefits offered by the FHA Plan. The mounting figures also suggest that it behooves the building industry itself to plan a little concentrated action for the coming months.

As a matter of fact, FHA officials throughout the country point out that the building industry is approaching that agency more and more frequently with coöperative suggestions and plans to make the most of the FHA modernization and repair program. In line with these suggestions, the FHA is preparing literature and display material for the trade. This is available at headquarters in Washington, or through the FHA's 64 field offices.

The material includes a colorful window display printed in red, blue, buff and black and a cleverly illustrated booklet with a check list for home owners, printed in red and black. A mimeographed piece will describe how dealers can develop and handle business under the "Property Improvement Credit Plan," Title I of the National Housing Act. It is a brief merchandising manual for dealers suggesting means by which they may increase their sales through the FHA plan of installment payments. This Dealer Guide is for distribution by manufacturers and trade associations to their sales outlets.

Both the display material and literature are available to all dealers wishing to be identified with the national modernization program, but it will be sent only on direct request. To avoid duplication, manufacturers and trade associations should have the dealers themselves send in their orders. It is suggested that this be done as soon as possible since quantities are limited and it is a case of "first come, first served," in filling requests.

The window-display pieces are designed to be used separately and may be adapted to the needs and display facilities of individual dealers. However, this material is essentially a unified window display in which all pieces are employed to feature the dealer's Merchandise. A colorful streamer bearing the legend, "Fix Up Your Home" extends across the window, and side streamers suggest improvements "Your Home Can Have." There are also "before and after" cards, posters and seals. In order to instruct dealers on how to arrange this material attractively in their windows, a descriptive folder has been prepared. This folder reproduces the window displays in full color. Copies are available for manufacturers, trade associations, and others who wish to tie in their sales outlets with the national modernization program.

Specimen newspaper advertisements are also prepared by the Federal Housing Administration for dealer use. These are mailed in proof form to local newspapers who will be supplied with mats of the art work on request.

Other mediums besides store display, direct mail, and newspapers will be used during the campaign. A car card will be released for national distribution in trains. cars and buses.

Special radio programs are being arranged locally by all state and District Offices of FHA. In addition, manufacturers. dealers, and others will be provided, upon request, with scripts and commercial announcements by which their products may be tied in to the national program for Home and Business Property Modernization.

A Technicolor movie, "Miracles of Modernization" is also being released to motion-picture houses all over the country. This film shows the actual transformations that modernization can make in a series of colorful "befores and afters." It is estimated that nearly 100,000,000 people will view this film within the next few months. Local theatre exhibitors should be consulted for information about dates of showings.

Of course, the lending institutions themselves will play an important part in the national modernization program. The Federal Housing Administration is supplying them with special posters reading, "We Make Loans to Modernize" which will be on display in their windows and on counters.

There are some 10,000 of these lending agencies who now hold contracts of insurance with the Federal Housing Administration to make Property Improvement Loans.

Any of these institutions will be glad to coöperate with dealers who refer them modernization prospects. They will also be able to supply FHA literature and printed forms as well as information about the FHA Plan. Lists of the qualified financial institutions in any locality may be obtained through the FHA field offices. or by writing direct to the Federal Housing Administration at Washington.

It is to the interest of every member of the building industry to be thoroughly familiar with the workings of the FHA Plan of Property Improvement Loans. Briefly the plan is this:

The applicant for the loan must have an adequate income and own the property or hold a lease that runs at least six months longer than the term of the loan. The charge for these loans can not exceed a discount of $5.00 per $100 face value of a 1-yr. monthly-payment note. The feature that appeals most strongly to the modernization prospect is the fact that the loan is repaid in equal monthly installments suited to his income.

The cost of both labor and equipment may be covered by the loan. This may include repairs, remodeling, additions and the installation of plumbing, heating or wiring. The building industry profits in two ways: more sales can be closed, and the dealer receives cash payment.

The CONCRETE MANUFACTURER

By W. R. JOHNSON

The Effect of Concrete-Mixer Action on the Grading of Fine Aggregate

IN the past a great many tests have been made dealing with the effect that the grading of the fine aggregate has on the resulting concrete. Practically all this work has been done in the laboratory, using small hand-mixed batches.

As a result of these tests, specifications are written for concrete aggregates in which the various sizes of material contained in the fine aggregate are limited and expected to come within certain percentage ranges designated in the specifications. The fines —that is, the material passing the No. 100 screen—are given particular attention, and are confined to comparatively narrow limits.

It is taken for granted by most engineers that very little change occurs in the grading of the material during the mixing action. This is probably true with regard to small batches mixed with a trowel or with shovels. It is also probably true where a natural sand is used in combination with a gravel, but where a crushed aggregate is used in combination with a natural sand or manufactured stone-sand, changes in grading are likely to occur.

While some data have been published on additional fines produced in transit mixers, in so far as the writer can determine, very little information has been published regarding the change in grading of the aggregate that may occur in the ordinary job mixer during the mixing period. While the changes produced in the coarse aggregate may not have any appreciable effect on the resulting concrete, the indications are that the additional fines produced in the fine aggregate may have considerable effect on the mix. In other words, the grading of the fine aggregate going into the mixer may be changed entirely when the batch comes out.

The writer recently had occasion to make a few tests in which the amount of fines produced in the mixer was measured by means of wash-down tests on concrete and aggregate samples. A wash-down test consists in taking a sample of material from the mixer and wet-screening it over the various sieves to determine its grading. In this test all the material passing the No. 100 sieve is considered as being a mixture of the cement and fines from the aggregate. By accurately weighing the amount of each size of material going into the batch and then weighing the ingredients retained on the No. 100 sieve coming out of the batch the percentage of additional fines can be calculated.

The material used in the tests consisted of two crushed stones, two stone-sands, and one natural sand. One of the crushed stones and stone-sands was a limestone, while the other crushed stone and stone-sand was a graywacke type of comparatively hard micaceous quartzite. Deval abrasion tests showed a wear of 4.0 per cent. for the limestone and 3.0 per cent. for the graywacke.

Tests made under the direction of Ivan L. Tyler, then Materials Engineer for the Tennessee Valley Authority at Hiwassee Dam, North Carolina, on samples of concrete from a 2½-cu.yd. batch after 2½ min. mixing in a 3-cu. yd. tilting mixer, using the crushed graywacke as fine and coarse aggregate, indicated increases of as much as 17 per cent., expressed as a percentage of the total weight of fine aggregate, in the fines (0-No. 100) contained in the sand. The coarse aggregate was graded from No. 4 to 6-in., and the fine from 0 to No. 4. About 25 per cent. sand, by weight, was used in the mix. Concrete test samples weighed about 100 pd. each. Screening samples larger than this was not considered practical as the concrete would have a tendency to set up before all of it could be put through the comparatively small screens available in the laboratory, and it was not considered advisable at this time to add sugar or some other retarder to prevent setting action.

In order to obtain information on other types of aggregate, tests were made in a 3½-cu.ft. tilting mixer in which the entire batch was put through the wash-down tests after the material had been mixed 2½ min. In these tests no cement was used in the mix. By eliminating the cement the entire batch of 300 pd. would be put through the screens without danger of setting before the test was completed. The omission of cement would no doubt increase the percentage of fines produced, but, on the other hand, the small mixer used would tend to cut down the fines due to the greatly decreased height through which the material would fall during the mixing ac-

EFFECT OF MIXER ACTION ON INCREASE OF FINES (0-NO. 100 MESH) IN SAND

Tests made in 3½-cu. ft. tilting type concrete mixer.
Materials: Fine aggregate graded from 0 to No. 4 and dried to constant weight before using.
Coarse aggregate graded from No. 4 to 6 in. and surface-dried before using.
Procedure: All material was weighed out in separate sizes in the quantities shown below. The coarse and fine materials were placed in the mixer at the same time and a nominal quantity (13 pd.) of water added. The mixer was run for 2½ min. and the material then dumped into a container. The material was then wet-screened over No. 4 and No. 100 sieves. All the material retained on the No. 4 sieve was then surface-dried, screened, and weighed. The material passing the No. 4 and retained on the No. 100 sieve was oven-dried, screened, and weighed. The material passing the No. 100 sieve was determined from the difference in weight between the original quantity and the quantity obtained after wet-screening and drying plus the additional material passing the No. 100 sieve during the final screening.
Figures in parentheses indicate column numbers.

Material Used		Coarse Aggregate				Fine Aggregate				Fines (0–No. 100)					
		Original Weight (*pounds*)	Weight After Mixing (*pounds*)	Loss in Weight		Original Weight (*pounds*)	Weight After Mixing (*pounds*)	Gain in Weight		Original Weight		Weight After Mixing		Additional Fines	
Coarse	Fine			(*pounds*)	%			(*pounds*)	%	(*pounds*)	%[1]	(*pounds*)	%[2]	(*pounds*)	%
		(1)	(2)	(1 minus 2)		(3)	(4)	(4 minus 3)		(5)		(6)		(6 minus 5)	
Graywacke	Graywacke	226.7	223.7	3.0	1.32	73.3	76.3	3.0	4.10	10.9	14.9	20.7	27.1	9.8	12.2
Limestone	Natural sand	225.0	218.2	6.8	2.89	75.0	81.8	6.8	9.07	0.9	1.2	6.8	8.3	5.9	7.1
Limestone	60% natural sand and 40% limestone screenings	225.0	218.2	6.8	2.89	75.0	81.8	6.8	9.07	3.8	5.1	12.6	15.4	8.8	10.3

[1] Percentage based on total weight of fine aggregate before mixing.
[2] Percentage based on total weight of fine aggregate after mixing.

tion. The results of the tests are shown in the table.

The data show that the graywacke aggregate produced 12 per cent. additional fines in the sand, when using the small mixer without cement in the mix. This compares with the 17-per cent. increase obtained in the 3-cu.yd. mixer when cement was used in the batch. The greater percentage of fines obtained in the large mixer indicates that the cushioning effect of the cement in the batch was not great enough to offset the more severe grinding action obtained in the large mixer due to its size.

The tests show that the graywacke coarse aggregate lost 3.0 lb. or 1.32 per cent. of its weight, while the limestone coarse aggregate lost 6.8 lb., or 2.89 per cent., of its weight. These losses are in line with the Deval abrasion tests made on the two materials. The graywacke fine aggregate, while gaining 3.0 lb., or 4.1 per cent., in weight from the coarse aggregate, also showed a gain of 9.8 lb. or 12.2 per cent., in the material passing the No. 100 sieve. This would indicate that most of the additional fines were the result of grinding down the fine aggregate rather than of abrasion losses in the coarse material. In the mixture of limestone coarse aggregate and natural sand the gain in weight of fine aggregate, due to the loss in the coarse aggregate, was 6.8 lb., or 9.07 per cent. On the other hand, the gain in weight in fines was only 5.9 lb., or 7.1 per cent. This would indicate a greatly reduced grinding action in the fine aggregate when a natural sand was used. When a mixture of 40 per cent. limestone screenings and 60 per cent. natural sand was used with limestone coarse aggregate, the gain in weight of fine material due to the loss from the coarse aggregate was 6.8 lb., or 9.07 per cent., which was exactly the same as obtained with the limestone-coarse-aggregate and natural-sand combination. The increase in fines, however, was 8.8 lb., or 10.3 per cent., indicating, as in the case of the graywacke combination, that considerable grinding action was taking place in the fine aggregate due to the presence of the limestone screenings.

While the data presented here are rather meager, the writer believes that some worth-while information can be developed by further studies along this line. For example, it would be very interesting to know the effect of the size of the aggreate, the effect of the size and type of mixer, the effect of the cement and water content, the effect of the time of mixing, the effect of the type of fine and coarse aggregate, and of various other factors.

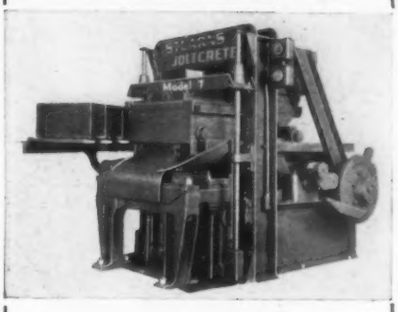
Meerschaum Deposits Occur Rarely in U. S.

Meerschaum ($H_4MgSi_3O_{10}$) is a soft (hardness, 2 to 2.5), fine-grained, earthy, white, gray or yellow material. The name "meerschaum" (German for "sea foam") suggests its light weight; the specific gravity is given as 1 to 2, but when pure and dry it will float on water. Owing to its resemblance to the porous, bonelike structure of the cuttlefish or sepia, the mineral is also known as "sepiolite." When wet the material is soft, even somewhat plastic, but it becomes hard and tough after drying again, the toughness being more apparent in varieties that have a fibrous or leathery texture.

There are a few scattered deposits of meerschaum in the United States that have yielded a small production, but the world's supply of the material is obtained principally from Asia Minor. Meerschaum deposits near Eskishehir, Turkey, have been worked for centuries, possibly as early as 2,000 years ago, and during the last 100 years their product enjoyed a large European market, being much carved in Vienna.

American deposits may have yielded a total of 1000 tons, chiefly from a deposit near Sapillo Creek, N. M.

The Vibration Machine Supreme



Vibration under pressure — 7,200 blows per minute—and ruggedly built to give long life, the Joltcrete machine is the choice of the wise concrete-products operator. Produces clean-cut, high strength units in any size, and gets the most out of a bag of cement. Built in three sizes with capacities of 7 to 9 standard units per minute.

Hobbs block machines, Anchor tampers Anchor Jr. strippers, Stearns power strippers and Joltcrete, Stearns mixers, and Cast Iron and Press Steel pallets, Straublox oscillating attachments, etc. Repair parts for: Anchor, Ideal, Universal, Stearns, Blystone mixers and many others.

ANCHOR CONCRETE MACHINERY CO.
G. M. Friel, Manager — Columbus, Ohio

STANDARD
Wherever Concrete Pipe Are Made

R&L "CRESCENT" Pipe Molds
For Either Wet or Hand Process Manufacture

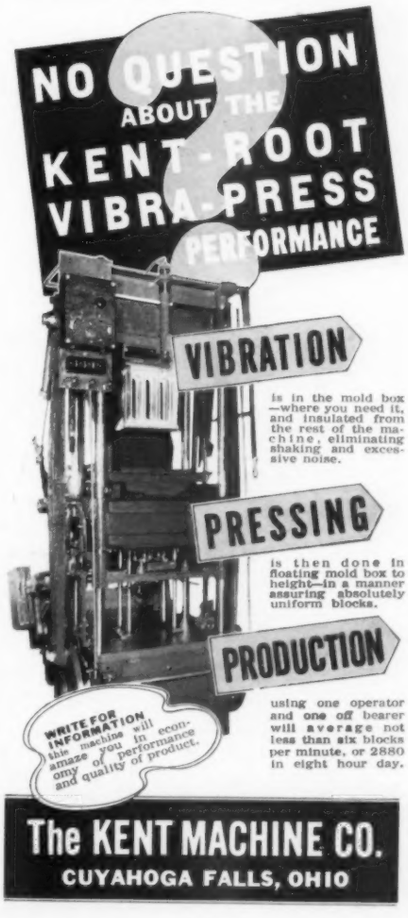
Made in any length or diameter with either Tongue and Groove, Bell and Spigot or Plain Ends.

Medium, Heavy and Extra Heavy Duty Forms for Sewers and Culverts, Well Casing, Drainage, Septic Tanks, etc.

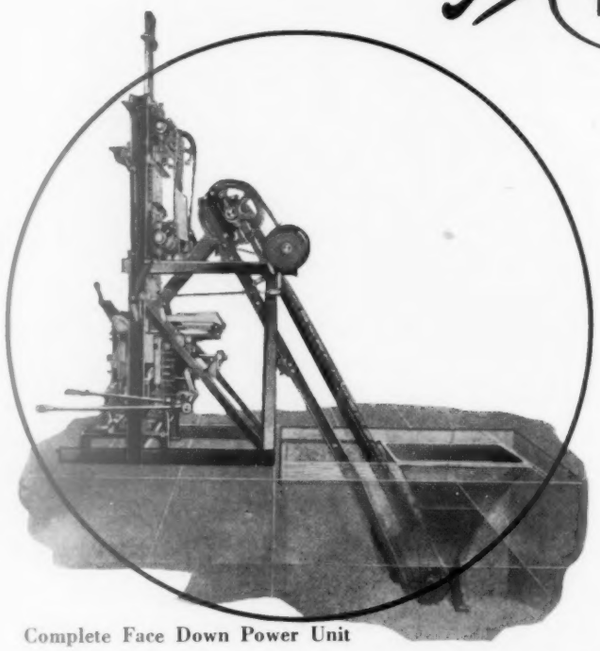
WRITE for Catalog and Prices.

R&L CONCRETE MACHINERY CO.
Kendallville, Indiana.

For more than 35 years makers of dependable concrete pipe molds and pipe machines.


NO QUESTION ABOUT THE
KENT-ROOT
VIBRA-PRESS
PERFORMANCE
VIBRATION
is in the mold box —where you need it, and insulated from the rest of the machine, eliminating shaking and excessive noise.
PRESSING
is then done in floating mold box to height—in a manner assuring absolutely uniform blocks.
PRODUCTION
using one operator and one off bearer will average not less than six blocks per minute, or 2880 in eight hour day.
WRITE FOR INFORMATION this machine will amaze you in economy of performance and quality of product.
The KENT MACHINE CO.
CUYAHOGA FALLS, OHIO

There are THOUSANDS of *Miles* CONCRETE EQUIPMENT AROUND the WORLD



Complete Face Down Power Unit

The *Miles* Complete Face Down Power Unit is recommended to producers who want quantity and quality production of concrete blocks at minimum labor and material costs.

This complete unit includes:

Miles No. 1 Block Machine
Miles Lever-Operated Strike-Off
Miles Automatic Power Tamper
Miles Elevator and Feeder.

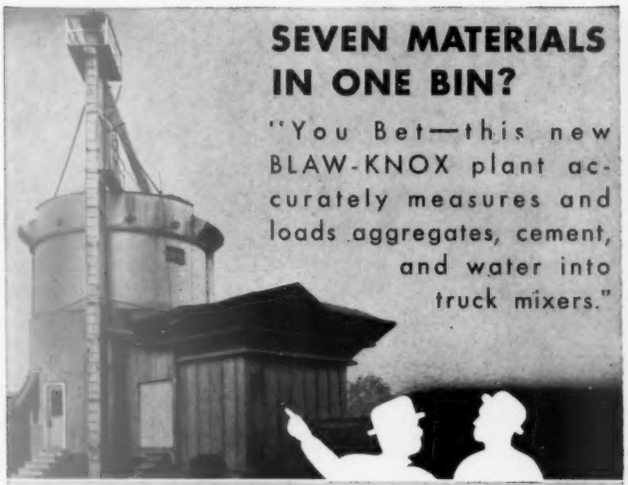
The machine is built extra heavy throughout, of the very best materials obtainable. Designed for high speed, sustained production and low maintenance.

With this machine you can easily average 1500 or more blocks per nine-hour day, both plain and face, of any design required. Blocks are uniform in texture, absolutely square, and have sharp, clean faces.

Miles Concrete Equipment is backed by more than forty years of experience, and has given *proved* satisfaction to thousands of users throughout the world.

Write for Catalog No. 334

THE MILES MANUFACTURING CO. JACKSON, MICHIGAN



SEVEN MATERIALS IN ONE BIN?

"You Bet—this new BLAW-KNOX plant accurately measures and loads aggregates, cement, and water into truck mixers."

Blaw-Knox Truck Mixer Loading Plants include overhead storage bins for aggregates and cement; accurate Weighing Batchers for aggregates, cement and water; arranged for manual or automatic operation; complete conveyors for handling materials from cars or trucks to bins, when desired—all properly designed and built to your requirements as an efficient unit for truck mixer loading. See Blaw-Knox Catalog No. 1582. 15

BLAW-KNOX BLAW-KNOX DIVISION OF BLAW-KNOX CO. Farmers Bank Bldg. Pittsburgh, Pa.
TRUCK MIXER LOADING PLANTS

"We're in this business to make money —and can do it with BLAW-KNOX TRUKMIXERS *because they mix concrete faster and we get more trips per day"*

It's a comfortable feeling to have truck mixers working for you that perform 100% under all conditions. No breakdowns—no worries.

You make a *profitable investment* when you buy Blaw-Knox Trukmixers and agitators. Write for Catalog No. 1582.

BLAW-KNOX BLAW-KNOX DIVISION OF BLAW-KNOX CO. Farmers Bank Bldg. Pittsburgh, Pa.
Agitators and TRUKMIXERS

If YOU are the MAN

WE WILL EQUIP YOU with exclusive line-production machinery — enabling you to manufacture modern building products at lowest cost. You will be able to supply the entire building trade with more attractive and permanent construction with savings at every step, from manufacturing to the completed job.

WE WILL SUPPLY YOU with new processes and formulas to enable you to manufacture products in 40 beautiful colors, shades and textures. Your product will be capable of meeting all known building requirements and is now being used by Government and City Building Departments throughout the country.

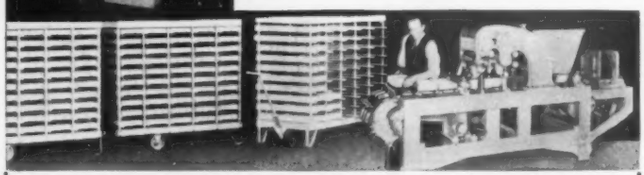
WE WILL GRANT YOU manufacturing franchise covering your locality, protecting your market, business and future, with available engineering and advertising service for rapid expansion of your business.

YOUR COMMUNITY will welcome your contribution to better buildings at lower cost. Your builders and prospective home owners are ready and waiting for better, lower cost materials which you will be able to supply.

YOUR EARNING POWER AND FUTURE. Present manufacturers have pioneered the way for you by establishing substantial business of their own. Some are selling at 100% over cost and securing the major share of the business in their territories.

YOUR OPPORTUNITY IS COMPLETE. One that is proven in every way. Prepared ready for you to cash in big on the wide building upturn under way.

YOU SHOULD INVESTIGATE while your territory is still open. Fill in and return coupon today. No obligation.



W. E. DUNN MFG. CO. 8-39
420 W. 24th St., Holland, Michigan

☐ Show me through your free books the possibilities of this business and the earning power of an exclusive plant in this territory, using my surplus aggregate.

☐ How a contractor can build better buildings for less with this permanent material.

Name _____

Address _____

City _____ State _____

Multiplex

MEANS *MORE* BUSINESS

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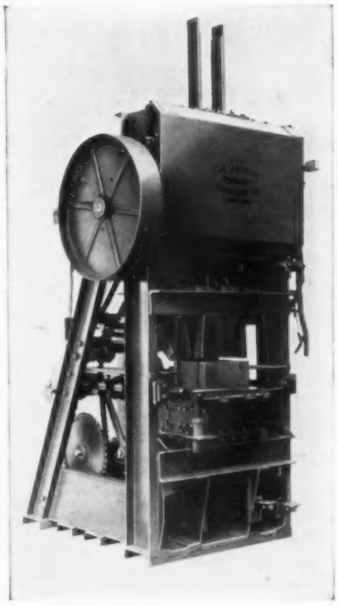


And the Concrete

SUPER TAMPER

is Engineered and Built to GET it

Successful business operations depend upon sustained PERFORMANCE—not claims. Years of study and research by our engineers resulted in the Multiplex Super Tamper—every part designed for perfect performance in producing concrete blocks.

This heavy duty, all-steel welded machine makes strong units with less tamping—reduced agitation of material and less vibration insure longer life. Has positive and automatic feed control; is adaptable for all kinds of aggregates.

Multiplex Super Tamper produces evenly finished and uniform units in all standard sizes, up to 6 per minute.

"SUPER TAMPER" Super Performance puts your business on solid concrete foundations.

* * * * *

Ask for facts about our new screw paddle Multi-Mixer—gives greater speed, more uniform mix.

Write for your copy →

The Multiplex CONCRETE MACHINERY COMPANY
ELMORE, OHIO

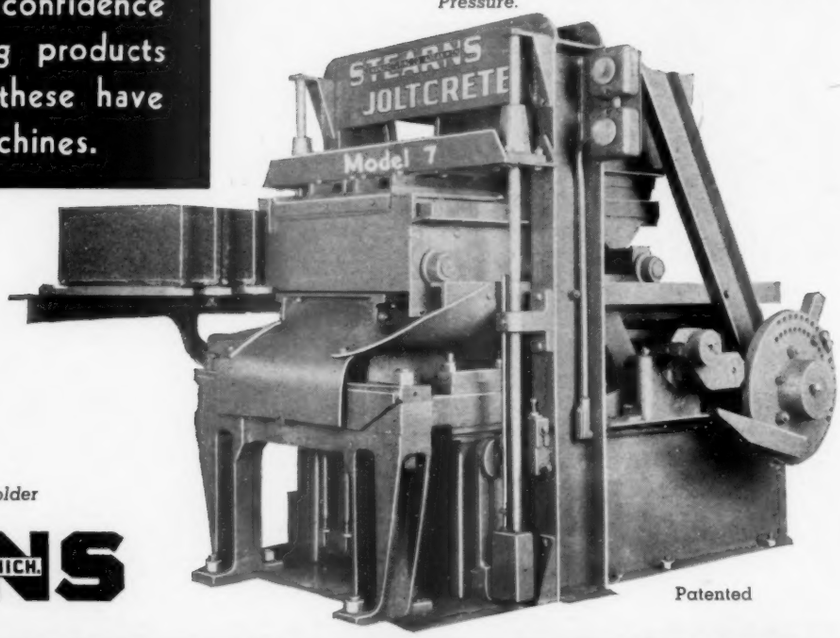
The CONCRETE MANUFACTURER

STEARNS JOLTCRETE

has been bought with confidence by 55 forward looking products manufacturers. Six of these have ordered their second machines.

Pioneers

Stearns Joltcrete is the result of seven years of experimental and three of successful commercial operation. Many exclusive patented features, including *Limited Amplitude Vibration* and *Vibration Under Pressure.*



Patented

Here's No. 7

Operates exactly like the original Stearns Joltcrete No. 9—makes two 8x8x16" blocks per cycle, 3½ cycles per minute. It's hard to compete against Stearns Joltcrete blocks!

Write for the New Stearns Joltcrete Folder

STEARNS
MANUFACTURING CO. - ADRIAN, MICH.
GENE OLSEN, PRESIDENT

Only Jaeger Truck Mixers Give You These Features . . .

- DUAL-MIX ACTION produces higher strength concrete—as proved by the Hollister Tests !
- THROW-BACK BLADES — essential to fast, thoro mix. Only Jaeger has them !
- DUAL-REVOLVING WATER SPRAYS — fastest water distribution; sprays to both ends of drum !
- SYPHO-METER TANK — insures accurate water control !
- VACUUM CAB CONTROL of shock-proof, 2-speed transmission — choice of truck engine or separate engine drive !
- COR-TEN STEEL — lighter, stronger, resists both rust and abrasion !

Send for new catalog showing why Jaeger Truck Mixers far outsell all others.

THE JAEGER MACHINE CO.
602 DUBLIN AVE., COLUMBUS, OHIO

SYMONS
CRUSHERS • SCREENS

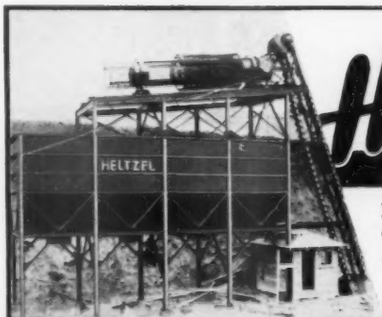
FINER PRODUCT
GREATER CAPACITY
LOWER CRUSHING COST

These advantages have made Symons Cones first among reduction crushers.

SIZES CLOSER
SAVES HEADROOM
ACTION IS POSITIVE

The trend is definitely toward level screening. Again Symons leads the way!

NORDBERG MFG. CO., MILWAUKEE WISCONSIN

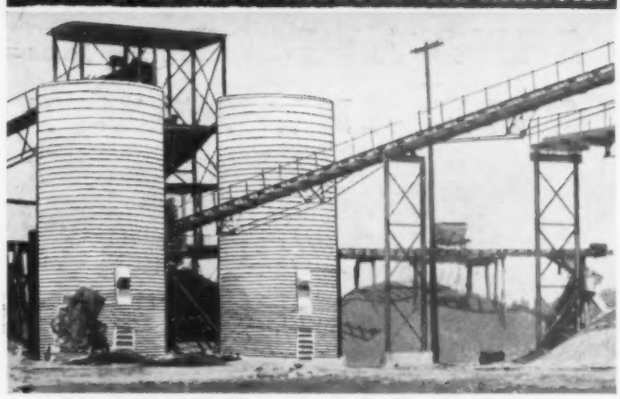


Heltzel
BUILDS IT BETTER

HELTZEL unit bins equipped for grading or screening any material. *Efficient — Practical Economical.*

HELTZEL STEEL FORM & IRON CO. WARREN, OHIO, U.S.A.

Another Progressive Bulk Product Firm "Goes More Modern" via Marietta



Replacing "Has-Bins with Marietta's Enduring Concrete Storage Bins

BUILD TO ENDURE

STOP waste of materials, labor, profits! Replace antiquated, fire-trap wood storage bins with Marietta Concrete. Pictured is new installation at Owensboro, Ky.—built to meet owners' *special* needs, for top-efficiency. Write (Engineering Dept.) TODAY for "Concrete Facts" on Marietta Storage Systems that pay high returns on investment.

MARIETTA CONCRETE CORP., Marietta, O. (Baltimore, Md.)

MARIETTA CONCRETE STORAGE SYSTEMS

COMMERCIAL PALLETS

A Prominent Block Machine Maker Has This to Say About Pressed Steel Pallets

"The use of pressed steel pallets is recommended because of their exact dimensions, their lightness, absence of breakage and economy of freight shipment.

"These pallets are used throughout the United States and are regarded by progressive products manufacturers as the most economical of all types available."

The cheapest investment in pallet equipment. Practically indestructible. Fit all machines, tamping and vibrating. Our catalog on request.

Write for Catalog
or
Ask Your Machinery Maker

The COMMERCIAL SHEARING & STAMPING COMPANY
YOUNGSTOWN, OHIO.

Give it the STOP WATCH TEST

DON'T . . .

take our word for it. Watch a Smith-Mobile in operation and give it the stop watch test. Prove to your own satisfaction that Smith-Mobile Truck Mixers are definitely faster in all three phases of the batch cycle . . .

FASTER charging because Smith-Mobile has a large roomy charging chute that makes it easy to spot mixer under bin gates. *No troublesome, leaky hatch to open or close.* Driver can stay in cab. Water is introduced through feed opening. No clogged water bells buried in concrete.

FASTER and better mixing. Shrinking and mixing start the instant the batch enters the drum, because *drum rotates during the charging operation.* Scientific blade design produces positive "end-to-end" movement of aggregates. Sealing door can be opened wide during mixing cycle. You can look in drum and actually SEE what's going on.

FASTER delivery of the concrete into the forms. High discharge permits steeper and longer distributing spout. Covers greater area even with dry concrete. No hoist or ramp required.

Write for complete Smith-Mobile story!

THE T. L. SMITH COMPANY
2887 N. 32nd St. • Milwaukee, Wis.

4 yard Smith-Mobile truck mixer — 6 yard agitator.

SMITH-MOBILE
THE *Modern* TRUCK MIXER and AGITATOR

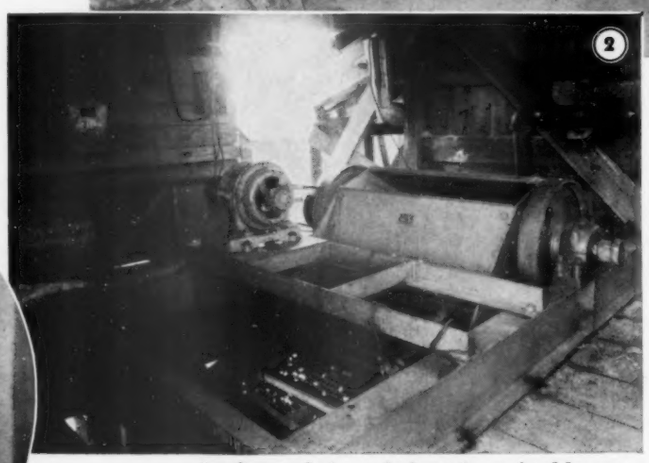
The CONCRETE MANUFACTURER

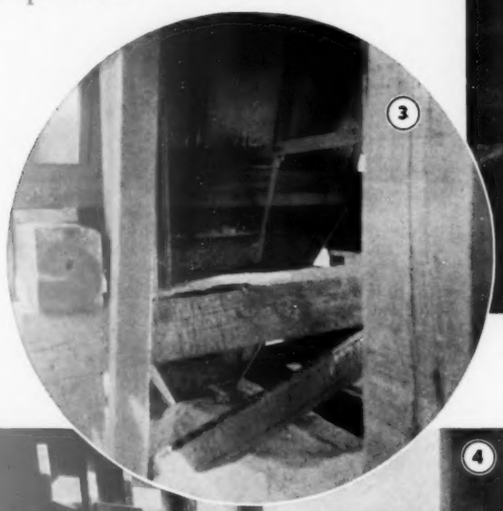
IT'S TELSMITH EQUIPMENT

AT THE TUSKEGEE SAND AND GRAVEL COMPANY PLANT

● This modern, all-electric powered plant of the Tuskegee Sand & Gravel Co., Tuskegee, Ala., is a fine example of both Telsmith equipment and Telsmith engineering service. The Tuskegee gravel washing plant, started early in 1938, is turning out 125 tons per hour, 30 per cent of which is pumped. Its five bins have a total capacity of 400 tons.

Gravel from the pit is hauled ¼ mile to the plant in 5-yd. side-dump cars, dumped into a 30-yd. hopper, and fed by a Telsmith Plate Feeder to a belt conveyor, which discharges to a 4 x 12-ft. Telsmith Four-Deck Pulsator driven by a 10-hp. motor.





1—*General view of plant from feed hopper.*
2—*4' x 12' Telsmith four-deck Pulsator.*
3—*No. 8 Telsmith Sand Tank.*
4—*No. 32-B Telsmith Reduction Crusher.*

Material is washed over this Telsmith vibrating screen under pressure; 900 g.p.m. of wash water being delivered by a motor-driven pump. Three sizes of gravel are produced. "Throughs" from its sand deck are flumed to a No. 8 Telsmith Sand Tank. With two sets of interchangeable screen trays, either concrete or mortar sand is recovered, as desired.

Oversize gravel from the screen goes to a bin with a slide gate which passes it right into the crusher. Working at choke feed, the No. 32 Telsmith Reduction Crusher takes it as fast as it comes—discharges to portable belt conveyor which loads it into railway cars. Using a 40-hp. motor with V-Belt drive, this Telsmith Crusher is very economical of power.

Telsmith designs and equips complete gravel pit and quarry plants . . . stationary, semi-portable or portable . . . exactly to fit *your* needs. High-grade equipment, sound engineering and centralized responsibility assure satisfaction to the buyer. *Write for Bulletin G-15.* GC-5-39

SMITH ENGINEERING WORKS
504 E. CAPITOL DRIVE MILWAUKEE, WIS.
Cable Addresses: Sengworks, Milwaukee—Concrete, London
Associates in Canada: Canadian Vickers, Limited, Montreal and Vancouver

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TELSMITH

50% MORE CAPACITY ONE THIRD THE WEIGHT

Here is what a No. 50 KUE-KEN crusher is doing for one enthusiastic owner. He has replaced a well known gyratory weighing 36,000 Lbs. with a KUE-KEN balanced crusher weighing only 11,500 Lbs. With the gyratory he could only crush 20 tons per hour to 1½" setting making a product 50% plus 1½" that had to be screened and recrushed. (1½" was as fine as he could set the gyratory.) With the KUE-KEN he is crushing 30 *tons an hour to 5/8" jaw setting making 95% minus 1".* A finished product—no screening or recrushing required. The owner is even more pleased with the perfect uniform cubical product the KUE-KEN makes compared to the slivery uneven product made with the gyratory.

A No. 50 KUE-KEN crushing extremely hard river gravel with a choke feed. The cool filtered oil bath to all mechanism keeps it cool even out in the blistering sun. The former crusher had to be shut down every 3 hours to cool off.

SEND FOR BULLETIN No. 600 TODAY

STRAUB MFG. CO. 528 CHESTNUT STREET OAKLAND, CALIFORNIA

EAGLE

"SWINTEK" SCREEN NOZZLE LADDER

MAKE MORE PROFITS ON YOUR PUMP

FIRST by pumping more solid material and by pumping it more economically!

This EAGLE "SWINTEK" CHAIN TYPE LADDER absolutely guarantees your pump dredge operation against any shutdown delays because of pipe lines clogged by over-sized material. The cutters on the traveling chain loosen and tear out the gravel, hardpan, boulders and the like, and carry away all such debris that would otherwise obstruct the freedom of the suction pipe line nozzle.

Actual operating figures of EAGLE "SWINTEK" Screen Nozzle Ladders have shown amazing production increases over plain suction with operating costs often cut more than half.

Send for your copy of descriptive bulletin giving complete facts about EAGLE "SWINTEK" advantages. ★ *It will pay you to investigate the complete line of EAGLE SCREW and PADDLE LOG WASHERS.*

EAGLE IRON WORKS

Des Moines, Iowa

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified.

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Aggregate-Bituminizing Plants
Hetherington & Berner, Inc.
McCarter Iron Works, Inc., The
*Warren Brothers Roads Co.

Agitators, Thickeners and Slurry Mixers
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

Air Compressors (Stationary)
Fuller Company

Air Conditioning
Jackson & Church Co.

Air Filters
*Blaw-Knox Co.
*Buell Engineering Co.
*Parsons Engineering Corp.

Air Separators
*Raymond Pulverizer Division of the Combustion Engineering Co.
*Williams Patent Crusher & Pulverizer Co.

Alloys (Steel)
Manganese Steel Forge Co.
Stulz-Sickles Co.

Ash and Refuse Handling Equipment
*Haiss Mfg. Co., Geo.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Asphalt Mixing Plants
Hetherington & Berner, Inc.
McCarter Iron Works, Inc., The
*Warren Brothers Roads Co.

Automatic Feeders
*Fuller Company
Jackson & Church Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McCarter Iron Works, Inc., The

Automatic Weighers
*Blaw-Knox Co.
*Fuller Company
*Jaeger Machine Co.
McCarter Iron Works, Inc., The

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*Bucyrus-Erie Co.

Balls (Grinding)
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Manganese Steel Forge Co.
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.

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Manganese Steel Forge Co.
*Smidth & Co., F. L.
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.

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Jackson & Church Co.

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Timken Roller Bearing Co.

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Flexible Steel Lacing Co.

Belt Lacing
Flexible Steel Lacing Co.

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Gates Rubber Co.
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McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
Sprout, Waldron & Co.

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Marietta Concrete Corp.

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*Universal Crusher Co.

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Blasting Machines
National Powder Co.

Blasting Supplies
*Ensign-Bickford Co.
National Powder Co.

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Miles Mfg. Co.

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Anchor Concrete Machy. Co.
Dunn Mfg. Co., W. E.
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Miles Mfg. Co.
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Anchor Concrete Machy. Co.
Dunn Mfg. Co., W. E.
*Kent Machine Co.
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Blocks (Sheave)
*Haiss Mfg. Co., Geo.
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Buell Engineering Co.

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*Blaw-Knox Co.
Concrete Transport Mixer Co.
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Jaeger Machine Co.
*Smith Co., T. L.

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Commercial Shearing & Stamping Co.

Bodies (Motor Truck)
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*Tyler Co., W. S.

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Buckets (Asphalt)
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*Haiss Mfg. Co., Geo.
Industrial Brownhoist Corp.
*Link-Belt Co.
Owen Bucket Co.

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Buckets (Elec. Heated, Weighing)
McCarter Iron Works, Inc., The

Buckets (Elevator and Conveyor)
*Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Manganese Steel Forge Co.
*Robins Conveying Belt Co.
Smith Engr. Works
Sprout, Waldron & Co.

Buggies (Dump)
*Koehring Co.

Bulk-Cement Storage Plants
Heltzel Steel Form & Iron Co.
McCarter Iron Works, Inc., The
Sprout, Waldron & Co.

Cableways
Gilmore Wire Rope Division of the Jones & Laughlin Steel Corp.
*Roebling's Sons Co., John A.
*Sauerman Bros., Inc.

Caps (Blasting)
National Powder Co.

Caps (Blasting, Electric)
National Powder Co.

Capstans (See Winches and Capstans)

Car Dumpers
*Link-Belt Co.

Car Pullers
Gilmore Wire Rope Division of the Jones & Laughlin Steel Corp.
Jackson & Church Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Car Wheels — (See Wheels — Car)

Carriers
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works
Sprout, Waldron & Co.

Carryalls
*Koehring Co.

Cars (Block, Concrete)
*Link Belt Co.
*Multiplex Concrete Machinery Co.

Cars (Brick Hardening Metal)
Jackson & Church Co.

Castings
*Eagle Iron Works
Hetherington & Berner, Inc.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan & Stone Corp.
*Robins Conveying Belt Co.
Sprout, Waldron & Co.

Castings (Gray Iron)
Jackson & Church Co.

Cement Pumps (See Pumps; Air Pumps; Pumps, Cement Slurry; Pumps, Bulk Cement)

Central Concrete Mixing Plants (Comp.)
Heltzel Steel Form & Iron Co.
*Jaeger Machine Co.
McCarter Iron Works, Inc., The
Sprout, Waldron & Co.

Chain (Dredge and Shovel)
Manganese Steel Forge Co.

Chain Drives
*Link-Belt Co.

Chain (Elevating and Conveying)
*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.
*McLanahan and Stone Corp.
Sprout, Waldron & Co.

Chutes and Chute Liners
Goodyear Tire & Rubber Co.
*Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.
McCarter Iron Works, Inc., The
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Smidth & Co., F. L.
Sprout, Waldron & Co.

Classifiers
*Deister Machine Co.
Iowa Mfg. Co.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
*Nordberg Mfg. Co.
Simplicity Engineering Co.
Straub Mfg. Co.

Cleaners (Oil)
Hilliard Corp., The

Clips (Wire Rope)
Gilmore Wire Rope Division of the Jones & Laughlin Steel Corp.
*Roebling's Sons Co., John A.

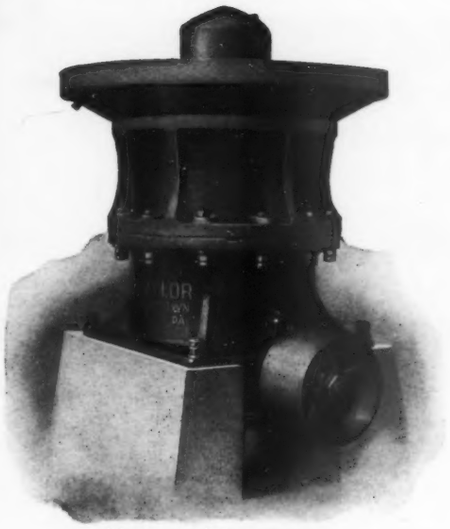
Clutches
*Jeffrey Mfg. Co.
*Link-Belt Co.
Sprout, Waldron & Co.

Coal-Pulverizing Equipment
*Jeffrey Mfg. Co.
*Raymond Pulverizer Division of the Combustion Engineering Co.
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.
*Universal Crusher Co.
*Williams Patent Crusher & Pulverizer Co.

Compressors (See Air Compressors)

Concentrators (Slurry)
*Deister Concentrator Co.

*See also detail information in the 1939 Pit and Quarry HANDBOOK.



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POWER-WHEEL
LEVER-ARM
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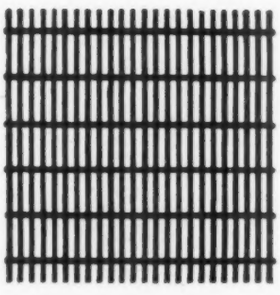

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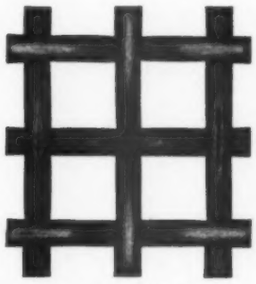
A wire cloth of guaranteed accuracy backed by fine workmanship and an effort to satisfy.

Available in Square Mesh and Rolled Slot. A trial will convince you of the superiority.



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A husky screen for scalping and sizing at capacities up to 1000 T. P. H.

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Best for fine screening at high speed. Adjustable slope and stroke.

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Reduce in ONE OPERATION

Jeffrey Heavy Duty Hammer Crushers reduce steam shovel size limestone shale in ONE OPERATION to 1½" and under suitable for storage and for blending as feed to raw grinding mills as in Cement Mill operations. One Jeffrey Crusher will do the work of several primary crushers of other makes. Write for literature.

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All parts of Jeffrey Heavy Duty Hammer Crushers are extra heavy and rugged to withstand severe and continuous service. Equipped with oversize slugger hammers and furnished with either heavy cast iron or Armorplate steel frames with manganese steel liners.

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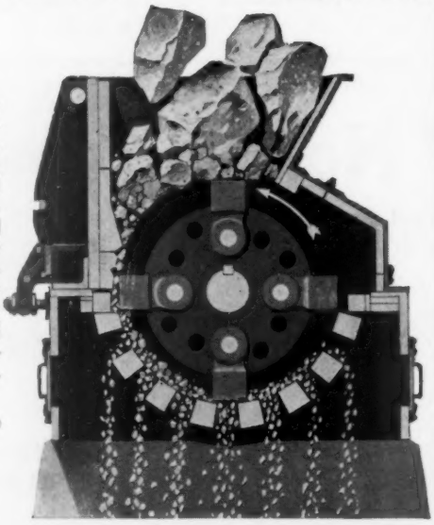

BUYERS' GUIDE

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Smith Engr. Works

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*Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Robins Conveying Belt Co.
Sprout, Waldron & Co.

Conveyor Idlers and Rolls
*Barber-Greene Co.
*Haiss Mfg. Co., Geo.
Iowa Mfg. Co.
Jackson & Church Co.
*Jeffrey Mfg. Co.
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*Barber-Greene Co.
*Fuller Company
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*Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
McLanahan & Stone Corp.
Miles Mfg. Co.
New Holland Machine Co.
*Robins Conveying Belt Co.
Smith Engr. Works
Sprout, Waldron & Co.
Straub Mfg. Co.
*Universal Crusher Co.

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*Fuller Company

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*Link-Belt Co.
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*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

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*Smidth & Co., F. L.

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Sprout, Waldron & Co.

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*Bucyrus-Erie Co.
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*Koehring Co.
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Industrial Brownhoist Corp.

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Industrial Brownhoist Corp.

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*Jeffrey Mfg. Co.
McLanahan and Stone Corp.
Rogers Iron Works
*Traylor Engr. & Mfg. Co.
*Universal Crusher Co.

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*Nordberg Mfg. Co.

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*Jeffrey Mfg. Co.
Straub Mfg. Co.
*Universal Crusher Co.
*Williams Patent Crusher & Pulverizer Co.

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Iowa Mfg. Co.
*Jeffrey Mfg. Co.
Lewistown Foundry & Machine Co.
*McLanahan and Stone Corp.
New Holland Machine Co.
*Nordberg Mfg. Co.
Rogers Iron Works
Smith Engr. Works
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Universal Crusher Co.

Crushers (Ring)
*American Pulverizer Co.
*Williams Patent Crusher & Pulverizer Co.

Crushers (Roll)
*American Pulverizer Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
*Robins Conveying Belt Co.
Rogers Iron Works
Straub Mfg. Co.
*Universal Crusher Co.
*Williams Patent Crusher & Pulverizer Co.

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*American Pulverizer Co.
Jackson & Church Co.
New Holland Machine Co.
*Williams Patent Crusher & Pulverizer Co.

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*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
Rogers Iron Works
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

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*Eagle Iron Works

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*Bucyrus-Erie Co.
*Koehring Co.

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*Bucyrus-Erie Co.
*Link-Belt Co.
*Sauerman Bros., Inc.

* See also detail information in the 1939 Pit and Quarry HANDBOOK.

Dragline Excavators
*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
Industrial Brownhoist Corp.
Jackson & Church Co.
*Koehring Co.
*Link-Belt Co.

Draglines (Walking)
*Bucyrus-Monighan Co.

Dredges
*Bucyrus-Erie Co.
Hetherington & Berner, Inc.
*Morris Machine Works

Driers
Iowa Mfg. Co.
Jackson & Church Co.
Lewistown Fdry. & Machine
*Link-Belt Co.
McCarter Iron Works, Inc., The
McLanahan & Stone Corp.
*Traylor Eng. & Mfg. Corp.
Tyler Co., W. S.

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*Bucyrus-Erie Co.

Drill Bits
*Bucyrus-Erie Co.

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*Bucyrus-Erie Co.

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*Bucyrus-Erie Co.
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Pennsylvania Drilling Co.

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*Bucyrus-Erie Co.

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Pennsylvania Drilling Co.

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Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

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*Bucyrus-Erie Co.

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*Bucyrus-Erie Co.

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*Link-Belt Co.

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*Blaw-Knox Co.
*Buell Engineering Co.
*Parsons Engineering Corp.

Dust Collecting Systems
*Blaw-Knox Co.
*Buell Engineering Co.
McCarter Iron Works, Inc., The
*Parsons Engineering Corp.
*Raymond Pulverizer Division of the Combustion Engineering Co.

Dust Conveying Systems
Allen-Sherman-Hoff Co.
*Blaw-Knox Co.
*Buell Engineering Co.
*Fuller Company
*Parsons Engineering Corp.

Dust Filters
*Buell Engineering Co.
*Parsons Engineering Corp.

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Elevators (See Conveyors and Elevators)

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Engineers
Bacon, Inc., Earle C.
*Fuller Company
Hetherington & Berner, Inc
Iowa Mfg. Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Smidth & Co., F. L.
Sprout, Waldron & Co.
*Traylor Engr. & Mfg. Co.

Engine Generator Sets
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*Nordberg Mfg. Co.

Engines (Internal-Combustion)
*Nordberg Mfg. Co.

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*Morris Machine Works
*Nordberg Mfg. Co.

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Excavators
Link-Belt Co.

Excavators—Shallow Grading (Bucket Elevator Type)
*Haiss Mfg. Co., Geo.

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National Powder Co.

Fabricating (Electric Arc and Oxy Acetylene)
Stulz-Sickles Co.

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*Jeffrey Mfg. Co.

Feeders
*Fuller Company
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McCarter Iron Works, Inc., The
*McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
Sprout, Waldron & Co.
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Universal Crusher Co.

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*Ensign-Bickford Co.
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*Cincinnati Rubber Mfg. Co.
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*Haiss Mfg. Co., Geo.
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*Jeffrey Mfg. Co.
*Link-Belt Co.
Sprout, Waldron & Co.

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*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Sprout, Waldron & Co.

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*Hendrick Mfg. Co.

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*Link-Belt Co.
*Traylor Engr. & Mfg. Co.

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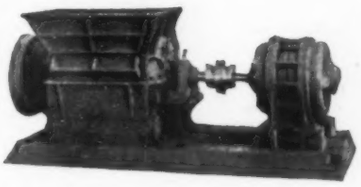
*Eagle Iron Works
*Hendrick Mfg. Co.
Iowa Mfg. Co.
Lewistown Fdry. & Mach. Co.
*Link-Belt Co.
Manganese Steel Forge Co.
*Robins Conveying Belt Co.
Smith Engr. Works

Guards (Wire)
Manganese Steel Forge Co.
*National Wire Cloth Co.

* See also detail information in the 1939 Pit and Quarry HANDBOOK.

HAMMER Mills

CRUSHERS AMERICAN



"AMERICAN" is the coast-to-coast standard in equipment for sustained quality production in any capacities from 10 to 100 tons per hour.

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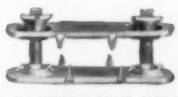
• FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. The wide space between outer bolts gives the fastener a long grip on the edges of the rip, while the center bolt prevents the fasteners from bulging.



• FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Five sizes in steel and alloys.

• Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco HD belt fasteners and rip plates. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.

Folder WRP shows exactly how to make tight butt joints in conveyor belts with Flexco HD Belt Fasteners. Also illustrates step by step the latest practice in repairing rips and putting in patches.

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4623 Lexington St., Chicago

Write for your copy

FLEXCO HD BELT FASTENERS
Sold by supply houses everywhere

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

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Taylor Forge & Pipe Works

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Hetherington & Berner, Inc.
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Iowa Mfg. Co.
Jackson & Church Co.
*Jaeger Machine Co.
*Jeffrey Mfg. Co.
McLanahan and Stone Corp.
*Sauerman Bros., Inc.
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Sprout, Waldron & Co.

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*Link-Belt Co.
Manganese Steel Forge Co.
McCarter Iron Works, Inc., The

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*Cincinnati Rubber Mfg. Co.
Gates Rubber Co.
Goodyear Tire & Rubber Co.

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Gates Rubber Co.

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Goodyear Tire & Rubber Co.

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*Jeffrey Mfg. Co.
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Smith Engr. Works
Sprout, Waldron & Co.

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*Fuller Company

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*Traylor Engr. & Mfg. Co.

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*Smidth & Co., F. L.

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*Eagle Iron Works

Ladders (Hydraulic Dredge)
*Eagle Iron Works

Lime-Handling Equipment
*Fuller Company
Iowa Mfg. Co.
Jackson & Church Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Raymond Pulverizer Division of the Combustion Engineering Co.
*Robins Conveying Belt Co.
*Traylor Engr. & Mfg. Co.

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*Bucyrus-Erie Co.
*Fuller Company
*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
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*American Pulverizer Co.
Jackson & Church Co.
*Jeffrey Mfg. Co.
Lewistown Fdry. & Mach. Co.
*Raymond Pulverizer Division of the Combustion Engineering Co.
Rogers Iron Works
*Smidth & Co., F. L.
Sprout, Waldron & Co.
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Universal Crusher Co.
*Williams Patent Crusher & Pulverizer Co.

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McCarter Iron Works, Inc., The
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Mixers (Concrete)
Anchor Concrete Machy. Co.
*Kent Machine Co.
*Link-Belt Co.
Miles Mfg. Co.
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*Koehring Co.

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*Hendrick Mfg. Co.
Rogers Iron Works
*Sprout, Waldron & Co.
Standard Stamping & Perf. Co.

Pipe, Dredge (Floating and Shore)
Naylor Pipe Co.
Taylor Forge & Pipe Works

Pipe Flanges
Hetherington & Berner, Inc.
Naylor Pipe Co.
Taylor Forge & Pipe Works

Pipe Fittings
Hetherington & Berner, Inc.

Pipe Forms (Concrete)
*R and L Concrete Machy. Co.

Pipe Machines (Concrete)
*R and L Concrete Machy. Co.

Pipe (Spiral)
Naylor Pipe Co.
Taylor Forge & Pipe Co.

Pipe (Water, Gas, Low Pressure Steam)
Hetherington & Berner, Inc.

Pipe (Welded)
Naylor Pipe Co.
Taylor Forge & Pipe Co.

Plug Valves (See Valves)

Pneumatic Conveying Systems (See Conveyors—Pneumatic)

Pneumatic Drills (See Drills, Rock)

Portable Conveyors
*Barber-Greene Co.
*Fuller Company
Haiss Mfg. Co., Geo.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
*Universal Crusher Co.

Portable Crushing and Screening Plants
*Barber-Greene Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*McLanahan and Stone Corp.
*Universal Crusher Co.
*Williams Patent Crusher & Pulverizer Co.

Portable Engines (See Engines—Internal Combustion)

Portable Loaders (See Loaders and Unloaders)

Portable Washing Plants
*Universal Crusher Co.

Powder, (Black, Blasting) (See Explosives)

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Miles Mfg. Co.

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Power Stripper Machines
Miles Mfg. Co.

Power Tampers (Concrete)
Anchor Concrete Machy. Co.
*Kent Machine Co.
Miles Mfg. Co.
*Multiplex Concrete Machinery Co.
*Stearns Mfg. Co.

Power Units (Internal Combustion)
*Nordberg Mfg. Co.

Pre-formed Wire Rope
*American Cable Division of the American Chain & Cable Co.

Press Machines (Hand, Concrete)
Anchor Concrete Machy. Co.
*Kent Machine Co.
*Multiplex Concrete Machinery Co.
*Stearns Mfg. Co.

Presses (Brick & Block)
Jackson & Church Co.

Proportioning Equipment
*Blaw-Knox Co.
Heltzel Steel Form & Iron Co.
Jackson & Church Co.
*Jaeger Machine Co.

Pulleys
*Link-Belt Co.
*McLanahan and Stone Corp.
Sprout, Waldron & Co.

Pulleys (Magnetic)
Sprout, Waldron & Co.

Pulleys (Wing)
Sprout, Waldron & Co.

Pulverized Fuel Systems
*Raymond Pulverizer Division of the Combustion Engineering Co.

Pulverizers (See also Crushers, Mills, etc.)
*American Pulverizer Co.
*Jeffrey Mfg. Co.
Lewistown Foundry & Machine Co.
New Holland Machine Co.
*Raymond Pulverizer Division of the Combustion Engineering Co.
*Smidth & Co., F. L.
Straub Mfg. Co.
Traylor Engr. & Mfg. Co.
*Universal Crusher Co.
*Williams Patent Crusher & Pulverizer Co.

Pump Valves (See Valves, Pump)

Pumps (Air-Lift)
*Fuller Company

Pumps (Bulk Cement)
*Fuller Company

Pumps (Cement Slurry)
*Morris Machine Works
*Smidth & Co., F. L.

Pumps (Centrifugal)
Hetherington & Berner, Inc.
*Jaeger Machine Co.
Kansas City Hay Press Co.
*Morris Machine Works

Pumps (Dewatering)
*Morris Machine Works

Pumps (Dredging)
Bucyrus-Erie Co.
Hetherington & Berner, Inc.
Kansas City Hay Press Co.
*Morris Machine Works

Pumps (Sand and Gravel)
Hetherington & Berner, Inc.
Kansas City Hay Press Co.
*Morris Machine Works

Pumps (Turbine)
*Morris Machine Works

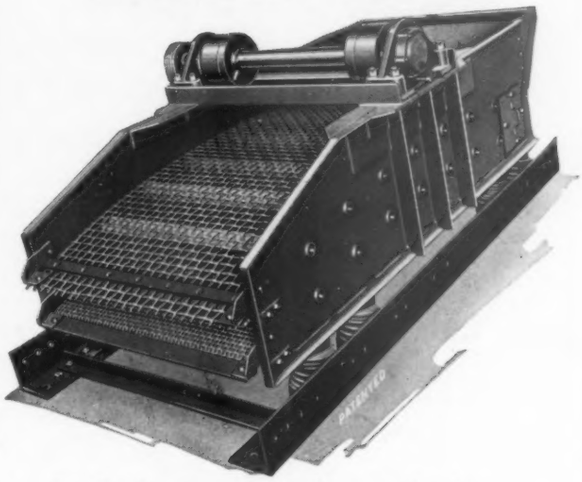
Pumps (Vacuum)
*Fuller Company

Pumps (Vertical)
*Morris Machine Works

Pumps (Well)
*Morris Machine Works

*See also detail information in the 1939 Pit and Quarry HANDBOOK.

DEISTER PLAT-O VIBRATING SCREEN



1. Simple powerful vibrating mechanism.
2. Screen cloth automatically held under uniform tension.
3. Any one screening surface changed without disturbing remaining decks.
4. Cushioned vibration.

DEISTER MACHINE CO.

1933 E. WAYNE ST. FT. WAYNE, IND.

SAUERMAN SLACKLINE CABLEWAY

The ideal machine for digging gravel from pit to stream. Delivers direct to top of screening plant.

SAUERMAN DRAG SCRAPER

The speediest and most economical machine for moving materials from banks and pits, also for stockpiling.

DIG · CONVEY · STOCKPILE

for a few cents per cubic yard

Producers of mineral aggregates in all parts of the world testify to their satisfaction with Sauerman Scrapers and Cableways for problems of digging, conveying and stockpiling.

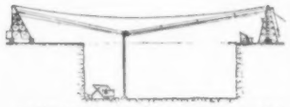
The first cost of a Sauerman machine is reasonable, operation is an easy one-man job, maintenance expense is small. As a result, materials are handled at amazingly low costs.

Write for 84-page catalog

SAUERMAN BROS., Inc., 434 So. Clinton St., Chicago

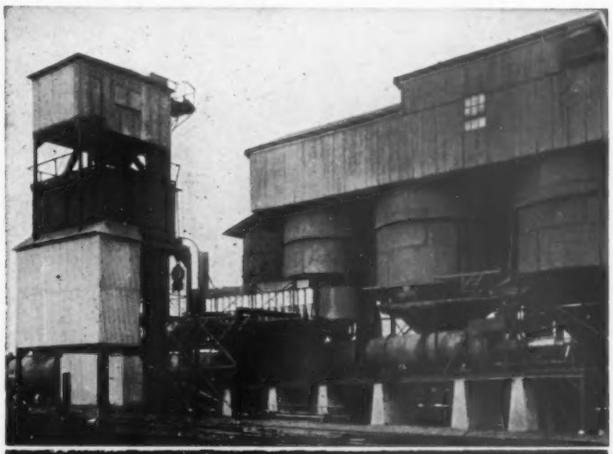
SAUERMAN SLACKLINE SCRAPER

Fast and efficient for digging from a wide pit and delivering to a belt conveyor, or elevator or loading into cars.



SAUERMAN TAUTLINE CABLEWAY

For conveying quarry rock or any work requiring the lifting, conveying and lowering of 2-ton to 20-ton loads.



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HOT MIX —— COLD MIX

—— OR ——

COMBINATION UNIT FOR BOTH TYPES

CAPACITY DESIGN AND ARRANGEMENT TO MEET ANY REQUIREMENTS

Designed and Built

—— By ——

WARREN BROTHERS ROADS CO.

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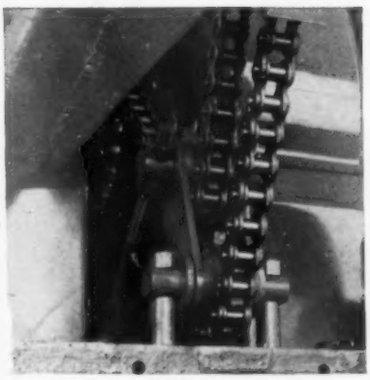
Not only INDEPENDENT and POSITIVE *but*



— one piece crowd chain

One-piece chain crowd is not new on the BAY CITY. It has always been standard equipment on all machines from smallest to largest. Maybe it does cost more to manufacture but it saves you many maintenance dollars and eliminates a lot of lost time. Also gives you wider working ranges. Ask for Catalog H-3.

BAY CITY SHOVELS, Inc., Bay City, Michigan

BAY CITY SHOVELS

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

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*Kent Machine Co.
*Multiplex Concrete Machinery Co.
*Stearns Mfg. Co.

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Heltzel Steel Form & Iron Co.
*Jaeger Machine Co.

Rock Drills (See Drills—Rock)

Rod Mills
Jackson & Church Co.
*Traylor Engr. & Mfg. Co.

Rods (Welding)
Gilmore Wire Rope Division of the Jones & Laughlin Steel Corp.
Stulz-Sickles Co.

Rope (Wire) (See Wire Rope)

Sand and Gravel Handling Equipment
*Jeffrey Mfg. Co.
*Link-Belt Co.
*McLanahan and Stone Corp.

Sand-Lime-Brick Machy.
Jackson & Church Co.

Sand Separators
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Simplicity Engineering Co.
Smith Engr. Works

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*Jeffrey Mfg. Co.
*Link-Belt Co.
*Nordberg Mfg. Co.
Smith Engr. Works

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*Link-Belt Co.
*Sauerman Bros., Inc.

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*Bucyrus-Erie Co.

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Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
*Deister Concentrator Co.
*Deister Machine Co.
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*Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
Ludlow-Saylor Wire Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*National Wire Cloth Co.
*Nordberg Mfg. Co.
*Robins Conveying Belt Co.
*Roebling's Sons Co., John A.
Rogers Iron Works
Simplicity Engineering Co.
Smith Engr. Works
Sprout, Waldron & Co.
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Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.
*Universal Crusher Co.

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*Barber-Greene Co.
*Deister Concentrator Co.
*Deister Machine Co.
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*Jeffrey Mfg. Co.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
*Nordberg Mfg. Co.
*Robins Conveying Belt Co.
Rogers Iron Works
Screen Equipment Co.
Simplicity Engineering Co.
Smith Engr. Works
Sprout, Waldron & Co.
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*Universal Crusher Co.
*Williams Patent Crusher & Pulverizer Co.

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*Link-Belt Co.
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Sprout, Waldron & Co.

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*Bucyrus-Erie Co.
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*Koehring Co.
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McCarter Iron Works, Inc., The
*Smidth & Co., F. L.

Skip Hoists and Skips
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McCarter Iron Works, Inc., The
*Robins Conveying Belt Co.

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*Link-Belt Co.

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*Deister Concentrator Co.

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*Jeffrey Mfg. Co.
*Link-Belt Co.
Sprout, Waldron & Co.
Straub Mfg. Co.

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*Jeffrey Mfg. Co.

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Manganese Steel Forge Co.

Steel (Open Hearth)
Gilmore Wire Rope Division of the Jones & Laughlin Steel Corp.
Manganese Steel Forge Co.

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Steel Plate Construction
Gilmore Wire Rope Division of the Jones & Laughlin Steel Corp.
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Hetherington & Berner, Inc.
Manganese Steel Forge Co.
McCarter Iron Works, Inc., The
Sprout, Waldron & Co.

Stone Grapples
Owen Bucket Co.

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*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Marietta Concrete Corp.
*Sauerman Bros., Inc.

Tamp Machines (Hand, Concrete)
Anchor Concrete Machy. Co.
*Kent Machine Co.
*Multiplex Concrete Machinery Co.
*Stearns Mfg. Co.

Tanks
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*Hendrick Mfg. Co.
Jackson & Church Co.
*Link-Belt Co.
McCarter Iron Works, Inc., The
*Traylor Engr. & Mfg. Co.

Tanks (Sand-Settling)
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Smith Engr. Works

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*Hendrick Mfg. Co.
*Tyler Co., W. S.

Tile Machines
Miles Mfg. Co.

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Goodyear Tire & Rubber Co.

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Goodyear Tire & Rubber Co.

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*Nordberg Mfg. Co.

Trailers
Ford Motor Co.

Trailers (Industrial)
Ford Motor Co.

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Hug Co., The

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Link-Belt Co.

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*Jeffrey Mfg. Co.
*Link-Belt Co.

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*Link Belt Co.

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*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

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Concrete Transport Mixer Co.
*Jaeger Machine Co.
*Smith Co., T. L.

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Goodyear Tire & Rubber Co.

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*Barber-Greene Co.
*Fuller Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Valves (Pump)
*Cincinnati Rubber Mfg. Co.
Taylor Forge & Pipe Works

Variable Speed Reducers or Transmissions
*Link-Belt Co.

Vibrating Screen Plate
Chicago Perforating Co.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.
Standard Stamping & Pref. Co.

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*Jeffrey Mfg. Co.
*Link-Belt Co.
*Tyler Co., W. S.

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Anchor Concrete Machinery Co.
Concrete Transport Mixer Co.
*Multiplex Concrete Machy. Co.
*Stearns Mfg. Co.

Wagons (Dump)
*Koehring Co.

Washers (Sand, Gravel and Stone)
*Eagle Iron Works
*Haiss Mfg. Co., Geo.
Iowa Mfg. Co.
Lewistown Foundry & Mach. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
*Smidth & Co., F. L.
Smith Engr. Works
Straub Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.
*Universal Crusher Co.

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Weighing Equipment (Automatic)
*Blaw-Knox Co.
*Fuller Co.
Heltzel Steel Form & Iron Co.
*Jaeger Machine Co.
McCarter Iron Works, Inc., The

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Iowa Mfg. Co.
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Wire Rope
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Gilmore Wire Rope Division of the Jones & Laughlin Steel Corp.
*Roebling's Sons Co., John A.

Wire Rope Fittings
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Gilmore Wire Rope Division of the Jones & Laughlin Steel Corp.
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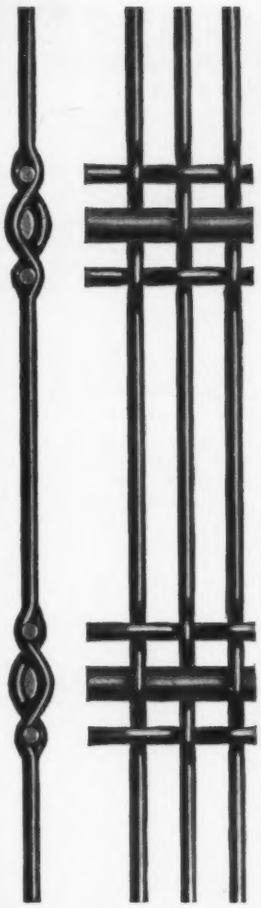
Manganese Steel Forge Co.
*Roebling's Sons Co., John A.

Worm Gears (See Gears and Pinions)

*See also detail information in the 1939 Pit and Quarry HANDBOOK.



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Long-Mesh
Woven Wire Screens

made to work under tension and vibration.

The straight stay - bars carry ALL the tension. The crimps in the round wires can not be stretched or broken. The screen can not be caused to sag or split by the pull of the tensioning device.

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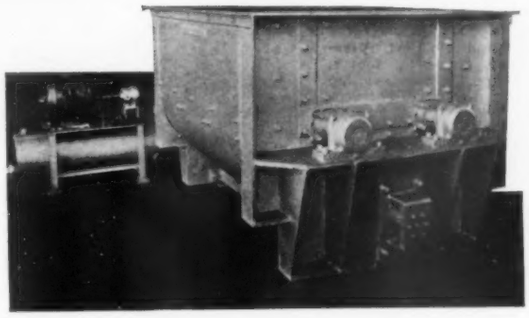
Asphalt Plant "MUST" in 3 Letters

McCARTER MODERN MIXERS



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Screens
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BUILT TO "SERVE AND SURVIVE"

DEMPSTER DUMPSTER "LOAD FORWARD" Model carrying 2 loaded Detachable bodies. The Skip type bucket shown is only one of the many types built for use with the Standard Dempster Hoisting Units.

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2 cu. yd. Heavy Duty for 1½ ton truck chassis
3 " " " " " 2-3 " " "

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GRINDING MACHINERY

for cement, lime, ores, etc.

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225 Broadway New York, N. Y.

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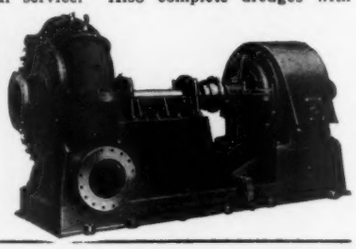
CENTRIFUGAL PUMPS

For hydraulic dredging, filling, sand and gravel production, hydraulic conveying of slurry and other liquids containing abrasive materials, clear water pumps for general service. Also complete dredges with all accessory equipment. Dredging pump designs include heavy-duty types and special alloy parts for severe service. Types and sizes for the largest or smallest operations, and for belt, motor, steam, oil or gasoline-engine drive.



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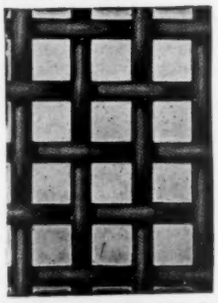
Of Nat-Aloy Wire Cloth

- ★ Wears five times as long as cloth made of ordinary steel.
- ★ Withstands vibration without crystallization.
- ★ Super-tough to resist abrasion.
- ★ Maintains accuracy throughout life of screen.
- ★ Has outworn other special alloy cloths.



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SQUARE
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of every description
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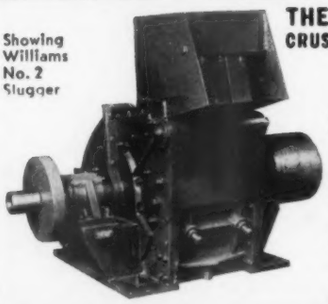

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THE WILLIAMS "SLUGGER" CRUSHER *for* MAKING 1¼", ¾" OR AGSTONE HANDLES LARGE STONE

Rows of heavy, free swinging, fast revolving hammers, crush the material by impact until of proper size to pass through the grates. By reducing large rock to 1¼", ¼" or agricultural size in one operation, the "Slugger" has enabled operators to produce these sizes at a very low cost per ton and with small investment.

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COMPLETE CONVEYOR SYSTEMS ENGINEERED TO YOUR NEEDS

Sprout-Waldron engineers will want to know the nature of material to be moved, the distance involved, the capacity required. Their job is to give you most efficient performance at lowest cost. Talk to a Sprout-Waldron sales engineer. There's no obligation, and he may be able to save you money. *Literature on request.*

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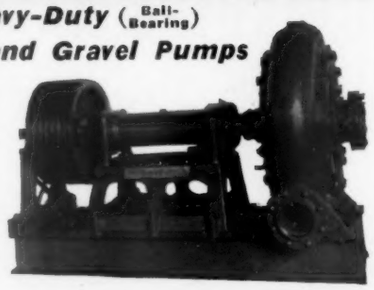
Heavy-Duty (Ball-Bearing) *Sand and Gravel Pumps*

High efficiency—low operating cost—precision workmanship—wear-resisting, non-heating bearings even when operated under extremely high heads. WRITE



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8 Barber-Greene conveyors, 24"x35', type N.
Brand new conveyor belt, special stock, 14" to 48".
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120 H.P. Gas engine, clutch, tex rope pulley.
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Gas locomotives, 2½ to 35 tons.
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4' 0" dia. x 30' 0" long, Rotary Dryer, practically new, reasonably priced.

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750 KW WEST. 125/250 V., 2400 A.C., 900 RPM
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200 KW G.E., 250 V., 2300/4000 A.C., 1200 RPM
200 KW G.E., 550 V., 2300/4000 A.C., 1200 RPM
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100 KW G.E., 250 V., 2300 A.C., 1200 RPM

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12x26 Champion, Screen & Elevator

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CARS: Six Clark 30 yd. capacity, standard gauge, all steel, 2-way air dump cars, apron type doors; Six Kopple 12 yd. all steel, standard gauge, hand dump cars; ten 50 ton, all steel, hopper bottom gondola cars.

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COMPRESSORS: One Ingersoll-Rand 320 cu. ft. portable, gas, on steel wheels.

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CRUSHER ROLLS: Two 16 x 36; one 16 x 42; one 24 x 54.

BELT CONVEYOR: One 36" x 200'.

DIESEL ENGINE: One 450 H.P. Cooper-Bessemer, 4 cylinder, 4 cycle, solid injection, 225 R.P.M., with or without 300 K.W.-A.C. Generator, 2300 volt, complete with all auxiliary equipment.

DREDGE PUMPS: One Morris 6" with 75 H.P., A.C. 220 volt, variable speed motor; also one Morris 10" Belt Drive.

DRILL SHARPENER: Ingersoll-Rand size 50, with Dies and Dollies for hollow, round, and Hex steel.

DRYER: One Ruggles Cole Double shell, 8'6" x 86'.

HOIST: Sullivan double drum, 50 H.P. electric, for sluicing and drag scraper work; one National 3 drum with swinger attached, with or without 65 H.P. Buda motor.

LOCOMOTIVES: Gasoline, 14 ton Whitcomb, 36" gauge, also one 25 ton Vulcan. Standard gauge.

KILNS: Two 7'6" x 100' and two 6' x 100'.

MAGNETIC PULLEY: 24" Dia., 48" Belt.

PUMP: One Fairbanks-Morse centrifugal, direct connected to 40 H.P.-A.C. Motor, capacity 1200 G.P.M. at 96' head.

PULVERIZERS: One Sturtevant No. 1 Ring Roll Mill. One Raymond Five Roller High Side Mill.

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TRACK: 600 ft. of 24" gauge, portable track, with switches and fifteen 1 yd. capacity all steel cars.

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1—Link-Belt K-44 shovel 50' boom, fairleads.
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4000' of 9" x 9" road forms.
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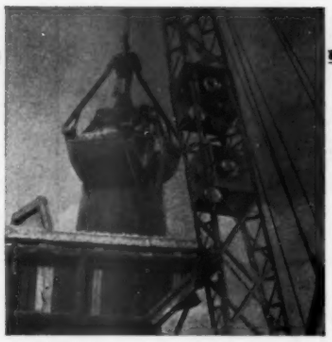

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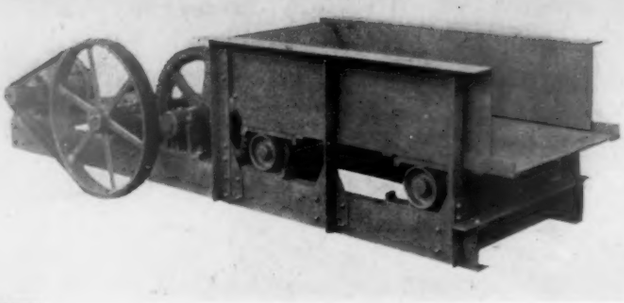

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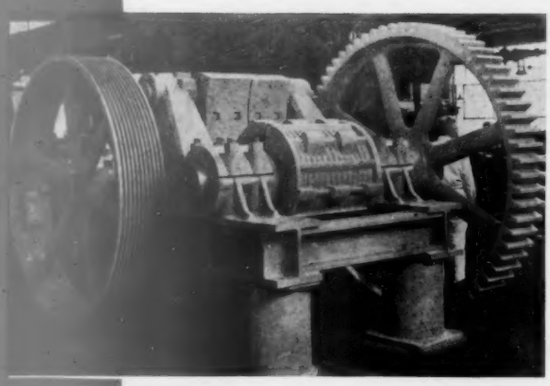

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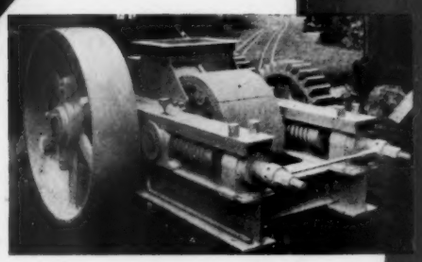

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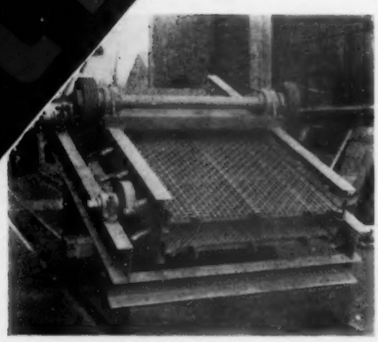

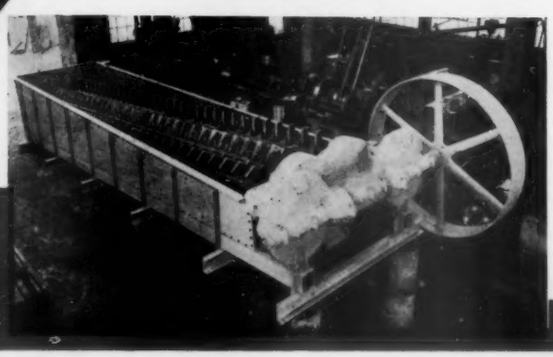

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